B.TECH

CURRICULUM-2021

SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

(DEEMED TO BE UNIVERSITY)

(Under Section 3 of the UGC Act 1956)

Anand Nagar, Krishnankoil-626 126.

Srivilliputtur, Virudhunagar(Dist.),Tamil Nadu, India

(Website: https://kalasalingam.ac.in/)

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

VISION

To be a University of Excellence of International Repute in Education and Research

MISSION

M1: To provide a scholarly teaching-learning ambience which results in creating graduates equipped with skills and acumen to solve real-life problems.
M2: To promote research and create knowledge for human welfare, rural and societal development.
M3: To nurture entrepreneurial ambition, industrial and societal connect by creating an environment through which innovators and leaders emerge

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To be a department of excellence for quality education and research in various fields of Computer Science and Engineering

MISSION

M1: Strive to build and maintain an academic atmosphere conducive to the highest levels of research and instruction by promoting high-quality teaching and scholarly activity.
M2: To equip students with knowledge and skills in both the fundamental and applied aspects of computer science, which are necessary to solve real-world engineering challenges to meet industry and societal needs.
M3: To prepare students to attain creative endeavours and entrepreneurship skills with proper ethical values and a desire to pursue life-long learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: The graduates will demonstrate technical proficiency in Computer Science and Engineering during employment or higher studies.
PEO2: The graduates will imbibe problem solving skills through continuous learning and innovative mindset to provide sustainable solutions.
PEO3: The graduates will operate in a diverse environment as a professional or an entrepreneur to solve societal problems with professional ethics.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO1: Able to develop software solutions for real world problems using core computing technologies.
PSO2: Able to apply contemporary technologies such as AIML and data science for effective decision-making towards sustainable development of a smart society.

PROGRAMME OUTCOMES (POs)

PO1 : Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 : Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 : Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 : Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6 : The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7 : Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 : Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 : Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12 : Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

ABET STUDENT OUTCOMES

Computing Accreditation Commission (CAC)

CSO1 : Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
CSO2 : Design, implement, and evaluates a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
CSO3 : Communicate effectively in a variety of professional contexts.
CSO4 : Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
CSO5 : Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
CSO6 : Apply Computer Science theory and software development fundamentals to produce computing-based solutions.

Engineering Accreditation Commission (EAC)

ESO1 : Ability to identify, formulate and solve complex engineering problems by applying principles of Engineering, Science, and Mathematics.
ESO2 : Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
ESO3 : An ability to communicate effectively with a range of audiences.
ESO4 : Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
ESO5 : Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
ESO6 : Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
ESO7 : Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Contents

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
B.Tech CSE - CURRICULUM STRUCTURE

S.no	Curriculum Components	Credits
I	**Foundation Core**	44
	Mathematics and Sciences	
	Engineering Sciences	
	Computing	
	Sustainable Product Development	
	Human Values and Communication	
	Entrepreneurship and Innovation	
II	**University Elective**	16
	Engineering(outside school)	
	Liberal arts (or) Mathematics and Sciences	
III	**Program Core**	52
IV	**Program Elective**	24
V	**Experiential Core**	16
	Design Project	
	Capstone	
VI	**Experiential Elective Courses**	8
	CSP/Internship/UG Research/Competitions	
VII	**Honors Elective**	20*
Total Credits		160

*180 credits is required to complete BTech Honors

1. Foundation Core

S.No	Course Code	Course Name	Course Type	L	T	P	X	C	H
1	211CSE1401	Problem Solving using Computer Programming	IC-T	1	0	2	3	3	6
2	211CSE1402	Python Programming	IC-T	1	0	2	3	3	6
Total Credits				6					

2. University Electives

S.NO	Course Code	Course Name	Course Type	L	T	P	X	C	H
1	214CSE1301	Windows programming	IC-T	2	0	2	0	3	4
2	214CSE2302	Getting started with data structure	IC-T	2	0	2	0	3	4
3	214CSE2303	Object Oriented Programming	IC-T	2	0	2	0	3	4
4	214CSE2304	Network programming	IC-T	2	0	2	0	3	4
5	214CSE2305	Cloud computing	IC-T	2	0	2	0	3	4
6	214CSE2306	Android Programming	IC-T	2	0	2	0	3	4
7	214CSE3307	Data Analytics with R	IC-T	2	0	2	0	3	4
8	214CSE3308	Introduction to Cyber Security	IC-T	2	0	2	0	3	4
9	214CSE3309	Introduction to Machine Learning	IC-T	2	0	2	0	3	4
10	214CSE4310	Ethical hacking	IC-T	2	0	2	0	3	4

3. Program Core

S.NO	Course Code	Course Name	Course Type	L	T	P	X	C	H
1	212CSE1101	IT Infrastructure Landscape Overview	T	4	0	0	0	3	4
2	212CSE2301	Data Structures	IC-T	2	0	2	3	4	7
3	212CSE2302	Digital Principles and System Design	IC-T	2	1	2	0	4	5
4	212CSE2403	Java Programming	IC-P	1	0	6	0	4	7
5	212CSE2303	Software Engineering	IC-T	2	0	2	0	3	4
6	212CSE2101	Discrete Mathematics	T	3	1	0	0	4	4
7	212CSE2304	Machine Learning	IC-T	2	0	2	3	4	7
8	212CSE2305	Database Management Systems	IC-T	3	0	2	0	4	5
9	212CSE2102	Computer Architecture and Organization	T	4	0	0	0	3	4
10	212CSE3301	Design and Analysis of Algorithms	IC-T	2	0	2	3	4	7
11	212CSE3302	Computer Networks	IC-T	2	0	2	3	4	7
12	212CSE3303	Operating Systems	IC-T	3	0	2	0	4	5
13	212CSE3304	Automata and Compiler Design	IC-T	3	0	2	0	4	5
14	212CSE3305	Secured Computing	IC-T	2	0	2	3	3	7
Total Credits				52					

4. Program Elective

S.No	Course Code	Course Name	Course Type	L	T	P	X	C	H
Stream : Artificial Intelligence and Machine Learning									
1	213CSE1301	Introduction to Artificial Intelligence and Machine Learning	IC-T	4	0	2	0	4	6
2	213CSE2301	Predictive Analytics	IC-T	4	0	2	0	4	6
3	213CSE2302	Algorithms for Intelligent Systems and Robotics	IC-T	4	0	2	0	4	6
4	213CSE2303	Computational Linguistics and Natural Language Processing	IC-T	4	0	2	0	4	6
5	213CSE3301	Deep Learning	IC-T	4	0	2	0	4	6
6	213CSE4301	Pattern and Anamoly Detection	IC-T	4	0	2	0	4	6
Stream : Data Analytics									
1	213CSE1303	Introduction to Data Analytics	IC-T	4	0	2	0	4	6
2	213CSE2305	Data Warehousing and Multidimensional Modeling	IC-T	4	0	2	0	4	6
3	213CSE2306	Data Visualization for Analytics	IC-T	4	0	2	0	4	6
4	213CSE3305	Descriptive Analytics	IC-T	4	0	2	0	4	6
5	213CSE3306	Big Data Analytics	IC-T	4	0	2	0	4	6
6	213CSE4305	Social, Web and Mobile Analytics	IC-T	4	0	2	0	4	6

S.NO	Course Code	Course Name	Course Type	L	T	P	X	C	H
Stream : Cyber Security and Forensics									
1	213CSE1302	Information Security Fundamentals	IC-T	4	0	2	0	4	6
2	213CSE2309	IT Physical Security and System Security	IC-T	4	0	2	0	4	6
3	213CSE3309	IT Application Security	IC-T	4	0	2	0	4	6
4	213CSE4307	Digital Forensics	IC-T	4	0	2	0	4	6
5	213CSE4308	IT Network Security	IC-T	4	0	2	0	4	6
6	213CSE4309	IT Data Security	IC-T	4	0	2	0	4	6
7	213CSE4310	Ethical Hacking & Penetration Testing	IC-T	4	0	2	0	4	6
Stream : Internet of Things and Smart City									
1	213CSE1304	Introduction to Internet of Things	IC-T	4	0	2	0	4	6
2	213CSE3310	Introduction to Sensor Technology and Instrumentation	IC-T	4	0	2	0	4	6
3	213CSE3311	Wireless Sensor Networks and IoT Standards	IC-T	4	0	2	0	4	6
4	213CSE3312	Cloud Computing Architecture and Deployment Models	IC-T	4	0	2	0	4	6
5	213CSE4311	Analytics for IoT	IC-T	4	0	2	0	4	6
6	213CSE4312	Smarter City	IC-T	4	0	2	0	4	6
Stream : Network and Security									
1	213CSE1305	Network and Information security	IC-T	3	0	2	0	4	5
2	213CSE2310	Pervasive and Ubiquitous computing	TP	3	0	2	0	4	5
3	213CSE2311	Virtualization	IC-T	3	0	2	0	4	5
4	213CSE2312	Mobile and Wireless Security	IC-T	3	0	2	0	4	5

S.NO	Course Code	Course Name	Course Type	L	T	P	X	C	H
5	213CSE3313	Graph theory and its applications	IC-T	3	0	2	0	4	5
Stream : Electrical and Electronics Communication									
1	213CSE2313	Embedded Systems	IC-T	3	0	2	0	4	5
2	213CSE2314	RFID and its Applications	IC-T	3	1	0	0	4	4
3	213CSE3314	Cognitive Radio	IC-T	3	1	0	0	4	4
4	213CSE3315	Principles of Communication	IC-T	3	0	2	0	4	5
5	213CSE3316	Signal and Image Processing	IC-T	3	0	2	0	4	5
S.NO	**Course Code**	**Course Name**	**Course Type**	**L**	**T**	**P**	**X**	**C**	**H**
Stream : Software Development									
1	213CSE1306	Web Technology	IC-T	3	0	2	0	4	5
2	213CSE2315	Software Testing	IC-T	3	0	2	0	4	5
3	213CSE2316	Mobile Application Development	IC-T	3	0	2	0	4	5
4	213CSE3317	Free and Open Source Software	IC-T	3	0	2	0	4	5
5	213CSE3318	User Interface Design	IC-T	3	0	2	0	4	5
6	213CSE3319	Agile Methodology	IC-T	3	0	2	0	4	5

5. Experiential Core

S.No	Course Code	Course Name	Course Type	L	T	P	X	C	H
1	215CSE2201	Design Project - I	Project	0	0	0	9	3	9
2	215CSE3202	Design Project - II	Project	0	0	0	9	3	9
3	215CSE4203	Capstone Project	Project	0	0	0	30	10	30
Total Credits				16					

6. Experiential Elective

S.No	Course Code	Course Name	Course Type	L	T	P	X	C	H
1	216CSE3201	Community Service Project	Project	0	0	0	9	3	9
2	216CSE2202	Industry Internship	Practical	0	0	4	0	2	4
3	216CSE4301	Applications of Machine Learning in Industry	IC-T	0	0	4	0	2	4
4	216CSE4302	BA for Industries	IC-T	0	0	4	0	2	4
5	216CSE4303	IOT for Industries (Use Case Scenarios)	IC-T	0	0	4	0	2	4
6	216CSE4304	Information Security Governance, Management Practices, Security Audit and Monitoring	IC-T	0	0	4	0	2	4
7	216CSE2201	Competitive Programming	Practical	0	0	2	0	1	2
8	216CSE3201	Micro Project	Practical	0	0	2	0	1	2

7. Honors Elective

S.No	Course Code	Course Name	Course Type	L	T	P	X	C	H
1	213CSE2101	Advanced Web Frameworks	T	3	0	0	0	3	3
2	213CSE2102	BlockChain Technology	T	3	0	0	0	3	3
3	213CSE2103	Video Analytics	T	3	0	0	0	3	3
4	213CSE3101	Advanced Computer Architecture	T	3	0	0	0	3	3
5	213CSE3102	Augmented Reality	T	3	0	0	0	3	3
6	213CSE3103	Advanced Databases	T	3	0	0	0	3	3
7	213CSE4101	High Performance Computing	T	3	0	0	0	3	3
8	213CSE4102	Next generation networks	T	3	0	0	0	3	3
9	213CSE4103	Visual Cryptography	T	3	0	0	0	3	3

1 FOUNDATION CORE

1.1 211CSE1401: PROBLEM SOLVING USING COMPUTER PROGRAMMING

211CSE1401	Problem Solving using Computer Programming	L 1	T 0	P 2	X 3	C 3
Pre-requisite :NIL **Course Category :**Foundation Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To introduce the students with the foundations of computing, programming and problem-solving
- To make the students understand the concept of data representation in computers
- To make the students solve simple and complex problems through programming concepts

COURSE OUTCOMES:

CO1: Understand and formulate algorithms and pseudocode for problems

CO2: Able to represent, organize, manipulate and interpret data

CO3: Apply programming skills to implement pseudocodes and algorithms

CO4: Apply user defined and built in functions to frame efficient programs

CO5: Apply programming techniques to permanently store and retrieve large datasets for the problems

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

PO'S												
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S	S	M		M						S	M
CO2	S	S	S		M						S	M
CO3	S	M	M								M	
CO4	S	M	M								M	
CO5	S	S	S		S						S	S

UNIT I

Problem Solving - Pillars of Problem Solving - Analysing and representing Algorithms – Flowcharts - Importance of programming in problem solving - Expressing Algorithms in Pseudocode - Case studies in the specific domain of study in analysing and representing algorithms

UNIT II

Computational thinking – Information to Data Format – Data Encoding – Binary Conversions and Binary Logic - Representation of Problem data in computer format - Introducing compiler, compiler features and, working with basic datatypes - working with DMA, creating strings using DMA concepts

UNIT III

Writing Problem Workflow in Computer Language – Use control structures to write simple algorithms for sort, search and similar algorithms – Organizing multiple datasets in problem domain to computer format – Working with Single dimensional, multidimensional arrays, One dimensional character arrays - Declaration and String Initialization Arrays of Strings

UNIT IV

Decomposing complex problems to simple solutions - functions – parameter passing – recursion - Organizing complex and variable datasets – Structures, self-referential structures – Unions – Applications

UNIT V

Representing and organizing large problem dataset – Files – Types - Modes - File operations – Applications, Idea of pointers, Defining pointers, Use of Pointers.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Practical (2 hours)	X-Component (3 Hours)
Week 1	What is a problem (boundaries of problem)- Introduction to Problem Solving – 4 Pillars of Problem Solving (Decomposition, Pattern Recognition, Data Representation, Algorithms)	Take Real life problems, Apply the four pillars in solving the problems (Individual / Group Activity can be planned)	Case studies in the specific domain of study (department specific) Identify the boundaries of the problem domain, find solution applying the pillars of problem solving Examples: Car Parking problem Water scarcity problem

Week 2	Analysing and representing Algorithms and *flowcharts (Common Algorithms to discuss)	Finding Maximum/Minimum Searching, Sorting (Algorithms & flowchart alone. No program)	Write algorithms for the problem chosen (Done in Week-1)
Week 3	Importance of programming in problem solving, Expressing Algorithms in Pseudocode	Practical exposure to computer and computer hardware, Introducing operating system, application software and compilers	Convert all algorithms to Pseudocode for the problem (Done in Week-2)
Week 4	Introduction to Computational thinking – Information to Data Format – Data Encoding	Practice with Numeral, Binary, Conversions to Binary	Identify the different data available in the problem (Done in Week-3)
Week 5	Representation of Problem data in computer format	Introducing compiler, compiler features and, working with basic datatypes	Analyse the proper data type and memory requirement for the problem (Done in Week-4)
Week 6	Representation of Problem data in computer format	Accessing data directly with computer memory	Calculate and identify memory limitations and wherever possible apply minimal memory access for the problem (Done in Week-5)
Week 7	Writing Problem Workflow in Computer Language	Use control structures to write simple algorithms for sort, search and similar algorithms	Convert pseudo codes to programs for the problem (Done in week 2-5)
Week 8	Organizing multiple datasets in problem domain to computer format	Organizing multiple datasets in problem domain to computer format	Analyse multiple datasets and represent the same in program(Done in Week 4)
Week 9	Organizing multiple datasets in problem domain to computer format	String operations, working with DMA, creating strings using DMA concepts	Wherever possible, apply dynamic memory creation instead of static in the problem (Done in Wee 3-4,8)

Week 10	Decomposing complex problems to simple solutions	Simple decomposition using functions	Decompose the complex problems to simple programs (Done in Week 7)
Week 11	Decomposing complex problems to simple solutions	Decomposition with parameters and recursion	Decompose the complex problems to simple programs (Done in Week 7)
Week 12	Organizing complex and variable datasets in problem domain to computer format	Create complex data using Structure.	Analyse complex data structures available in the problem. Apply the same in Program(Done in Week 4)
Week 13	Organizing complex and variable datasets in problem domain to computer format	Implementation of single Linked list	Write the programs integrating complex data structure (Done in Week 12, 11)
Week 14	Representing and organizing large problem dataset in secondary storages	Reading, Writing	Check for Large Data Set as inputs to the system / necessity for permanent storage to the solution (Done in Week 13)
Week 15	Representing and organizing large problem dataset in secondary storages	Develop solutions for domain specific problems.	Represent the data in Permeant storage for the problem (Done in Week 14)

TEXT BOOK(S):

1. David D. Riley and Kenny A. Hunt, ComputationalThinking for the Modern Problem Solver, CRC Press, 2014.

2. Pradip Dey and Manas Ghosh,Programming in C,Oxford University Press, Third Edition 2018.

3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill, Third Edition, 2010

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India, Second Edition 1988

2. 2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill, Seventh Edition 2017

1.2 211CSE1402: PYTHON PROGRAMMING

211CSE1402	**Python Programming**	**L** 1	**T** 0	**P** 2	**X** 3	**C** 3
Pre-requisite :NIL **Course Category :**Foundation Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to design object-oriented programs with Python classes.
- To practice data processing, analysis and visualization with python

COURSE OUTCOMES:

CO1: Understand the constructs and concepts of a programming language

CO2: Apply Python data structures for problem solving and programming

CO3: Implement user defined python functions and build an efficient program leveraging modules

CO4: Create python programs to handle file I/O and exceptions, and solve problems with Object Oriented Concepts

CO5: Understand Data processing, Validation, Visualization concepts in python with regex, pandas, matplotlib and numpy packages.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

PO'S												
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S	S									S	
CO2	S	S									S	
CO3	S	M	M								M	
CO4	S	S			S						S	S
CO5	S	M	M		S						M	S

UNIT I: Getting Started with Programming

Introduction, Python Versions, Applications of Python in mainstream technologies.
Strings and Formatting: Basic Syntax, Comments, String Values, String Methods, The format Method, String Operators, Numeric Data Types, Conversion Functions, Simple Output, Simple Input, The % Method, The print Function
Language Components: Indenting Requirements, the if Statement, Relational and Logical Operators, Bit Wise Operators, the while Loop, break and continue, The for Loop.

UNIT II: Python Data Structures

Introduction to Python Data Structures, Lists, Tuples, List Comprehensions, Nested List Comprehensions, Sets, Dictionaries, Sorting Dictionaries, Copying Collections, Dictionary Comprehensions, Dictionaries with Compound Values

UNIT III: Functions and Modules

Functions: Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function, map, filter, Mapping Functions in a Dictionary, Lambda, Inner Functions, Closures
Modules: Modules, Standard Modules – sys, math, time, The dir Function

UNIT IV: Exceptions, I/O and OOP

Exceptions: Errors, Runtime Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, raise, assert.
Input and Output: Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data from a File
Object Oriented Programming: Class Coding Basics Class Statement Methods Inheritance Attribute Tree Construction Specializing Inherited Methods Class Interface Techniques Abstract Super Classes

UNIT V: Data Processing, Analysis and Visualization

Regular Expressions: Introduction, Simple Character Matches, Special Characters, Character Classes, Quantifiers, The Dot Character, Greedy Matches, Grouping, Match-

ing at Beginning or End, Match Objects, Substituting, Splitting a String, Compiling Regular Expressions, Flags.
Numerical Analysis & Plotting: Numpy – Overview, Setup, Datatypes, Basic Operators, Indexing, Broadcasting, Matrix Operators. Matplotlib-Overview, Setup, Basic plots, Customizing plots, Subplots, 3D plots.
Data Processing with Pandas: Pandas – Overview, Setup, Data Structures, Indexing & Selecting Data, groupby Operations, Reshaping data.

X Component

- **Competitive coding using Core Python** – Practical Assignments and Hackerrank challenges
- **GUI Development using Python** – Project

Syllabus for GUI Development

An Example GUI, The Tk Widget, Button Widgets, Entry Widgets, Text Widgets, Checkbutton Widgets, Radiobutton Widgets, Listbox Widgets, Frame Widgets, Menu Widgets, Toplevel Widgets, Dialogs

15 WEEK COURSE PLAN

Week	Lecture (1 hours)	Pedagogy	Practical (2 hours)	X Component (3 hours)
Week 1	Introduction to Python – Applications of Python in Mainstream Technologies	Explicit Teaching	Python Versions, Installing Python, Environment Variables, Executing Python from the Command Line	Access and perform operations on Open Source Environments like Raspberry Pi
	Strings in Python	Explicit Teaching/ Demonstration	String functions and formatting	
	Language Components – Part 01: Simple if	Explicit Teaching	Indenting Requirements, the if Statement	
Week 2	Language Components – Part 02: Relational and Logical Operators, Bit Wise Operators	Explicit Teaching/ Demonstration	while Loop, break and continue, for Loop	Provide programming solution for decision and looping problem scenarios

	Lists, Tuples	Explicit Teaching	Hands-on session for Lists and Tuples - methods and functions Hackerrank – Problem Solving Challenge	
Week 3	Sets, Dictionary	Explicit Teaching	Hands-on session for Sets and Dictionary - methods and functions	Create solutions for complex problem statements leveraging Python Data structures
	Comprehension	Explicit Teaching	List Comprehension, Dictionary Comprehension, Lambda, Hackerrank – Problem Solving Challenge	
Week 4	Functions	Explicit Teaching	Getting started with function oriented programming	Apply the buit-in and user defined functions to create efficient programs leveraging Python modules.
	Modules	Explicit Teaching	Modular Programming, Built-in Modules	
Week 5	Exceptions	Explicit Teaching	Practicing programs that are robust against exceptional inputs	Get data from sensors through Raspberry Pi, with appropriate Exceptional Handling
	Input/Output	Explicit Teaching	Getting data out from Excel, Notepad	
Week 6	Object Oriented Programming: Class Statement Methods Inheritance	Explicit Teaching	Attribute Tree Construction Specializing Inherited Methods, Class Interface Techniques Abstract Super Classes	Create Object Oriented Solution for solving application oriented problems

Week 7	Regular Expressions, Simple Character Matches, Special Characters, Character Classes, Quantifiers, The Dot Character	Explicit Teaching	Practicing regular expression rules for different problem scenarios	Validate data using RegExp package for realtime inputs, from integrated environment
	Greedy Matches, Grouping, Matching at Beginning or End, Match Objects, Substituting, Splitting a String, Compiling Regular Expressions, Flags.	Explicit Teaching		
Week 8	Numerical Analysis, Datatypes, Basic Operators, Indexing, Broadcasting, Matrix Operators.	Explicit Teaching	Performing operations on data frames obtained from real time datasets	Perform complex mathetical operations leveraging Numpy
Week 9	Plotting, Basic plots, Customizing plots, Subplots, 3D plots	Explicit Teaching	Practicing data plots for Real time datasets	Perform data visualization on streaming data
Week 10	Data Processing, Data Structures, Indexing & Selecting Data, groupby Operations, Reshaping data.	Explicit Teaching	Working with data processing operations using Pandas	Process data from benchmark sites using Pandas, Numpy, Matplotlib

Week 11	Tkinter: Tk Widget, Button Widgets, Entry Widgets, Text Widgets, Checkbutton Widgets, Radiobutton Widgets, Listbox Widgets, Frame Widgets, Menu Widgets, Toplevel Widgets, Dialogs	Explicit Teaching	Tkinter Programming for UI Snips	Create a well-defined user interface, based on the problem requirement (GUI Development)
Week 12	Developing User Interface with OOP	Explicit Teaching	Efficient UI Development using Tkinter and OOP	
Week 13	Desktop App Development	Project Based Learning	Problem Identification and Backend details	
Week 14	Creating own Python Packages	Project Based Learning	Pip, PyPi, Licence Reception	
Week 15	UI Development	Project Based Learning	UI Development for Integrated Application	

EXPERIMENTS:

1. Let d(n) be defined as the sum of proper divisors of n (numbers less than n which divide evenly into n).
   If d(a) = b and d(b) = a, where a $\neq$ b, then a and b are an amicable pair and each of a and b are called amicable numbers.
   For example, the proper divisors of 220 are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110; therefore d(220) = 284. The proper divisors of 284 are 1, 2, 4, 71 and 142; so d(284) = 220.
   Find the count of the matching proper divisors of the given amicable number

2. We come across varying magic numbers or so called occult numbers. There are very few numbers in having a particular property. The so called occult number in our scenario is the number, whose individual digits' factorial sum will give back the same number.
   For instance: 40585 = 4! + 0! + 5! + 8! + 5! = 40585
   Calculate the number of occult numbers in the less than a particular value 'alpha'
   Alpha will be given in the input

3. A positive integer, n, is factorised into prime factors. We define f(n) to be the product when each prime factor is replaced with 2. In addition we define f(1)=1. For example, 90=2*3*3*5, then replacing the primes, 2*2*2*2=16, hence f(90)=16. Calculate f(n), for the given n

4. Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:
   1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...
   By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms upto the given V terms series.

5. Namonical charge is a value that is calculated by inputting the name of the person. The charge is calculated by first coverting the characters in the name to its corresponding alphabetical position and then accumulating a sum based on the following rules:
   (i) if the number is even, take factorial of it
   (ii) if the number is odd, take the square root of the number
   The accumulated sum is returned as the Namonical charge of the given name
   Eg.
   name = "abcd"
   a - 1 (odd, take square root)
   b - 2 (even, take factorial)
   c - 3 (odd, take square root)
   d - 4 (even, take factorial)
   Namonical charge = sqrt(1) + factorial (2) + sqrt(3) + factorial(4) = 28.732
   Note: Round the output to three decimal digits

6. For a positive integer n, define f(n) to be the number of non-empty substrings of n that are divisible by 3. For example, the string "2573" has 10 non-empty substrings, three of which represent numbers that are divisible by 3, namely 57, 573 and 3. So f(2573)=3.
   If f(n) is divisible by 3 then we say that n is 3-like.
   If the given number is 3-like, print 'yes', otherwise print 'no'

7. Natural Numbers are simply the numbers 1, 2, 3, 4, 5, ... (and so on).
   Given a number k and N, take sum of all numbers less than or equal to N, that are divisible by k.
   Example:
   Given k = 5, N = 10, the natural numbers less than or equal to 10 and divisible by 5 are 5,10
   The sum is 5+10=15

8. Sorting is a base for any problem solving. Sorting can be done in ascending or descending order. Various algorithms exist in the literature to do the sorting efficiently.
   Create a sorting algorithm that sorts elements between a particular range (i,j)
   Example:
   Given the inputs
   7 // Number of elements

5 2 6 3 9 1 7 // The array (index starts from zero)
2 // Start range
5 // end range
Output:
5 2 3 6 9 1 7

9. Convert the given word into magnet word. Magnet word is a word which will have a property.
   Each character of the word will be assigned index starting from 1.
   Alphabets in English will be numbered from index 1.
   Reverse of the multiplied indices of the character in string and alphabers, mod 26 gives the corresponding magnetic character.
   Replace all the characters in the given string with its magnetic character, resulting in magnetic word.
   Note: If a character is changed to magnetic once, all its subsequents appearances will have the same magnetic character.
   (space character remains untouched)
   The elements between the range 2 and 5-1 are sorted

10. Ak gave a challenge to Vj. Ak gave a decimal number N.
    Vj needs to find the product of unique critical digits of the number N.
    Critical digits are those digits which are divisible by X.
    The value X is 2, if the number of unique even numbers is greater than those of unique odd numbers, else, the value of X is 1.
    Help Vj to crack the challenge.
    Eg. N = 123564.2654916465
    If the count of numbers to the left of . (dot) is greater than the count of numbers to the right, then . (dot) is considered as even number. Else . (dot) is considered as odd number. In above case, . (dot) is considered as odd number.

11. n! means n × (n - 1) × ... × 3 × 2 × 1
    For example, 20! = 2432902008176640000,
    The number is so long. We need to compress this number in such a way that much information is not last.
    Essential information of the number is its case: even or odd. We shall preserve the highest case in the given number (i.e.,) if the number of even numbers is greater than the odd, then even is the highest case, and vice versa.
    The resultant compressed number should have unique numbers in ascending order.

12. RSK is going to play KPL in 2021. RSK consist of many players in its player pool in different type: batsman, bowler, wicket keeper and all-rounder. Each player will have a X factor determining his own strength. In addition to strength, the mode of the player, either aggressive or defensive will also be provided.
    Team RSK management and its captain is in ambiguity on how to select their best team. The selected team should be highly competent in the tournament. A team can be competent enough only when it has competent players in aggressive mode.
    Given with the set of team player details including their X factor, mode and type, the task is to form an optimal team.
    A team should require minimum two batsmen, one bowler and one wicket keeper

out of its 11 field players. Team should contain minimum 4 aggressive players Note: An all-rounder can be accounted as either batsmen or bowler
Help team RSK management to finds its best 11-squad to win the trophy. Prove to the management by selecting a optimal team with highest cumulative x-factor value

TEXT BOOK(S):

1. Mark Lutz, "Learning Python", Fifth Edition, O,Reilly, 2018

REFERENCES:

1. Charles Severance, 2016, Python for everybody: exploring data in Python 3
2. Charles Dierbach, 2013, Introduction to Computer Science using Python: a computational problem-solving focus, Wiley Publishers

2 UNIVERSITY ELECTIVE (from CSE)

2.1 214CSE1301: WINDOWS PROGRAMMING

214CSE1301	Windows Programming	L	T	P	X	C
		2	0	2	0	3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the customize and install windows.
- To demonstrate the configure updates for windows.
- To implement the configure devices and drivers for windows.
- To design to configure the storage for windows.
- To analyze the remote management settings in windows.

COURSE OUTCOMES:

CO1: Understand the customize and install windows

CO2: Demonstrate the configure updates for windows

CO3: Implement the configure devices and drivers for windows

CO4: Design to configure the storage for windows

CO5: Analyze the remote management settings in windows

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			M		M	M				M	
CO2			S							S		
CO3	M	M		S								
CO4								S	S	M	S	S
CO5				S	S							

UNIT I: INSTALLING WINDOWS

Introducing windows - Editions of windows – Requirements – features – how to install the OS – Methods for migrations and upgrading – Migrate content using the User State Migration Tool - deployment options – common tools used in deployment process – Upgrading windows – client installation options.

UNIT II: POST INSTALLATION CONFIGURATION AND PERSONALIZATION

Post installation tasks in windows – customize user interface – control panel – settings app – configure common OS settings – device drivers – managing and configuring hardware peripherals – printer – client side printing – managing print server properties - configure windows start menu – common configuration options – Advanced configuration methods – Managing drivers and devices- device specific settings.

UNIT III: UPDATING WINDOWS AND CONFIGURING NETWORKING

Windows servicing model – apply to various scenarios – Methods for updating windows and applications – managing updates - group policy – windows update for business - Networking concepts – IPV4 – IPV6 –DNS – Configure IP Network Connectivity - Implement Name Resolution - Remote Access Overview - Remote Management

UNIT IV: CONFIGURING STORAGE

Overview of storage options - benefits of storage space - Storage configuration – management – local – cloud –virtual storage options – configuring storage on client devices – introducing storage spaces – managing storage spaces - Maintaining disks and volumes – configuring local disk partitions and volumes - compressing folders - Enabling disk quotas – Creating a storage space - Synchronizing files with OneDrive.

UNIT V: MANAGING APPS IN WINDOWS

App management in Windows – Different types of apps – installation methods – manual – automated methods – Manage App delivery – Windows store – Differences between Microsoft Edge and Internet Explorer – Managing universal windows apps – web browsers – features - sideloading an App – Installing and Updating Microsoft store apps – Configuring Internet Explorer Enterprise Mode.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)

Week 1	Introducing windows,Editions of windows, Requirements,features,how to install the OS,Methods for migrations and upgrading,Migrate content using the User State Migration Tool	Direct instruction(PPT)	To learn about upgrading of windows.
Week 2	Deployment options,common tools used in deployment process	Interactive instruction(PPT)	To configure settings app and control panel.
Week 3	Upgrading windows,client installation options	Direct instruction(Videos)	To study about Group policy objects.
Week 4	Post installation tasks in windows, customize user interface,control panel,settings app,configure common OS settings,device drivers	Explicit Teaching	To implement powershell to configure windows.
Week 5	Managing and configuring hardware peripherals,printer,client side printing,managing print server properties	Flipped Learning	To manage the local and network printers.
Week 6	Configure windows start menu,common configuration options,Advanced configuration methods,Managing drivers and devices,device specific settings.	Case Study based Learning	To learn about windows servicing model.
Week 7	Windows servicing model,apply to various scenarios,Methods for updating windows and applications,managing updates	Explicit Teaching	To configure IP network connectivity.
Week 8	Group policy,windows update for business, Networking concepts,IPV4,IPV6,DNS	Problem solving	To study about implementing name resolution.
Week 9	Configure IP Network Connectivity, Implement Name Resolution,Remote Access Overview,Remote Management	Direct instruction(PPT)	To implement wireless network connectivity.

Week 10	Overview of storage options,benefits of storage space,Storage configuration,management,local,cloud,virtual storage options	Flipped Learning	To study about remote management.
Week 11	Configuring storage on client devices, introducing storage spaces,managing storage spaces,Maintaining disks and volumes	Case Study based Learning	To implement Recovering using Driver Rollback
Week 12	Configuring local disk partitions and volumes,compressing folders,Enabling disk quotas,Creating a storage space,Synchronizing files with OneDrive	Direct instruction(PPT)	To implement Troubleshooting Desktop Apps
Week 13	App management in Windows,Different types of apps,installation methods,manual,automated methods,Manage App delivery	Interactive instruction(PPT)	To study about Monitoring Events
Week 14	Windows store,Differences between Microsoft Edge and Internet Explorer,Managing universal windows apps	Interactive instruction(PPT)	To Create Firewall Rules
Week 15	Web browsers,features, sideloading an App,Installing and Updating Microsoft store apps,Configuring Internet Explorer Enterprise Mode.	Direct instruction(PPT)	To Configure Windows Defender

EXPERIMENTS:

1. To learn about upgrading of windows.
2. To configure settings app and control panel.
3. To study about Group policy objects.
4. To implement powershell to configure windows.
5. To manage the local and network printers.
6. To learn about windows servicing model.

7. To configure IP network connectivity.
8. To study about implementing name resolution.
9. To implement wireless network connectivity.
10. To study about remote management.
11. To implement Recovering using Driver Rollback
12. To implement Troubleshooting Desktop Apps
13. To study about Monitoring Events
14. To Create Firewall Rules
15. To Configure Windows Defender

TEXT BOOK(S):

1. Lambert Joan, Lambert Steve, Windows 10 Step by Step, PHI Learning Pvt Ltd, 2016.

REFERENCES:

1. Kevin Wilson , Computer Training: Windows 10, Elluminet Press, 2015.

2.2 214CSE2302: GETTING STARTED WITH DATA STRUCTURE

214CSE2302	**Getting Started with Data Structure**	**L** 2	**T** 0	**P** 2	**X** 0	**C** 3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Prepare the students to understand and gain the knowledge about Data Structure.
- Gain knowledge on Data Structure algorithms and apply the same on real time data extracted from confined sources.
- Familiarise the students with C programming pertaining to Data Structure.

COURSE OUTCOMES:

CO1: Understand the different categories of data Structures

CO2: Evaluate and create Abstract Data Types Stack.

CO3: Design and implement linear data structures such as Queues.

CO4: Design and implement linear data structures such as Linked Lists.

CO5: Analyze efficiency of various sorting and searching techniques.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			S		M	M				M	
CO2												
CO3	S	M		S				S			M	L
CO4									S			
CO5				S	S					S		

UNIT I: INTRODUCTION TO DATA STRUCTURES

Basic Terminologies: Elementary Data Organizations, Data Structure, Operations: insertion, deletion, traversal etc.Analysis of an Algorithm, Notations, Time-Space trade off.

UNIT II: STACKS

ADT Stack and its operations: Algorithms and their complexity, analysis, Applications of Stacks: Expression Conversion and evaluation corresponding algorithms and complexity analysis.

UNIT III:QUEUES

ADT queue, Types of Queue: Simple Queue, Circular Queue, Operations on each types of Queues: Algorithms and their analysis.

UNIT IV: LINKED LISTS

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

UNIT V: SORTING AND SEARCHING

Objective and properties of different sorting algorithms, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Performance and Comparison among all the methods. Searching: Linear Search and Binary Search.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Basic Terminologies: Elementary Data Organizations, Data Structure.	Direct instruction(PPT)	Write a Program to search an element in array.
Week 2	Operations: insertion, deletion, traversal etc.	Direct instruction(PPT)	Write a R Write a Program to Find the minimum element in a sorted and rotated array.
Week 3	Analysis of an Algorithm, Notations, Time-Space trade off.ADT Stack and its operations	Direct instruction (PPT)	Write a Program for array implementation of Stack.
Week 4	Algorithms and their complexity, analysis	Direct instruction(PPT)	Write a Program for various applications of Stack.
Week 5	Applications of Stacks	Direct instruction (PPT)	Write a Program for array implementation of Queue.

Week 6	Expression Conversion and evaluation corresponding algorithms and complexity analysis.	Direct instruction(PPT)	Write a program Linked list based implementation of Queue.
Week 7	ADT queue, Types of Queue: Simple Queue, Circular Queue.	Direct instruction(PPT)	Write a Program to implement the Linked List.
Week 8	Operations on each types of Queues: Algorithms and their analysis.	Direct instruction (PPT)	Write a Program for linked list implementation of Stack.
Week 9	Singly linked lists: Representation in memory.	Direct instruction(PPT)	Write a Program for linked list implementation of Stack.
Week 10	Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list;	Direct instruction(PPT)	Write a Program for single linked list implementation of Queue.
Week 11	Linked representation of Stack and Queue, Header nodes,	Direct instruction(PPT)	Hand session for Doubly linked list: operations on it and algorithmic analysis.
Week 12	Circular Linked Lists: all operations their algorithms and the complexity analysis.	Direct instruction(PPT)	Write a Program for double linked list implementation of Queue.
Week 13	Objective and properties of different sorting algorithms	Direct instruction (Demonstration)	Write a Program to implement various Sorting techniques.(Selection Sort, Bubble Sort)
Week 14	Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort.	Direct instruction (Demonstration)	Write a Program to implement various Sorting techniques(Insertion Sort, Quick Sort.
Week 15	Performance and Comparison among all the methods. Searching: Linear Search and Binary Search.	Interactive instruction (Problem solving)	Write a Program to implement various Searching techniques.(Merge Sort, Heap Sort).

EXPERIMENTS:

1. Write a Program to implement the Array concept.
2. Write a Program for array implementation of Stack.
3. Write a Program for various applications of Stack.
4. Write a Program for array implementation of Queue.

5. Write a Program to implement the Linked List.
6. Write a Program for linked list implementation of Stack.
7. Write a Program for linked list implementation of Queue.
8. Write a Program to implement various Sorting techniques.
9. Write a Program to implement various Searching techniques.

TEXT BOOK(S):

1. Fundamentals of Data Structures, Third Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press,2010

REFERENCES:

1. Algorithms, Data Structures, and Problem Solving with C++, Third Edition by Mark Allen Weiss, Addison-Wesley Publishing Company ,2011.
2. How to Solve it by Computer, 2nd Impression by R. G. Dromey, Pearson press,2010.

2.3 214CSE2303: OBJECT ORIENTED PROGRAMMING

214CSE2303	Object Oriented Programming	L 2	T 0	P 2	X 0	C 3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To learn Object Oriented Programming concepts.
- To understand how C++ improves C with object-oriented features.
- To learn Java Programming Concepts to solve problems.

COURSE OUTCOMES:

CO1: Understand the basic concepts of OOPS and syntax in C++.

CO2: Create C++ programs using classes and constructors.

CO3: Understand the basic concepts of overloading and inheritance.

CO4: Understand the basic concepts of OOPS in Java.

CO5: Apply the programming concepts of JAVA to solve problem.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			M		M	M				M	
CO2			L		S			M		L		
CO3	M	S		S								L
CO4				M					S			
CO5				S	M							

UNIT I: INTRODUCTION

Introduction to OOP: Basic Concepts of OOP- Applications of OOP. Introduction to C++ - Input and Output Declarations in C++ - Namespaces - Function Prototypes - Inline Functions - Default Arguments- Unary Scope Resolution Operator.

UNIT II: CLASSES, CONSTRUCTORS AND FRIEND CLASS

IIntroduction Comparing class with Structure: Class Scope - Accessing Members of a class. Constructor - Destructor - Passing and Returning Objects from Functions- Friend Class and Friend function.

UNIT III: OVERLOADING AND INHERITANCE

Operator Overloading Fundamentals – Restrictions- Overloading stream Insertion and Stream Extraction Operators- Overloading Unary Binary Operators. Inheritance Introduction Types - Protected Members Public - Protocols and Private Inheritance - Direct Base Classes and Indirect Base Classes.

UNIT IV: JAVA BASICS

History of Java- Java Buzzwords - Data Types Variables - Scope and Life Time Of Variables - Arrays - Operators- Expressions - Control Statements - Type Conversion and Casting - Simple Java Program - Concepts of Classes Objects Constructors Methods - Access Control- This Keyword - Garbage Collection - Overloading Methods and Constructors - Parameter Passing- Recursion - Nested and Inner Classes- Exploring String Class.

UNIT V: INHERITANCE,PACKAGES AND INTERFACE

Forms of Inheritance- Class Hierarchy- Benefits of Inheritance - Member Access Rules -Super Uses - Using Final With Inheritance - Polymorphism- Method Overriding - Abstract Classes - Defining - Creating And Accessing A Package - Understanding CLASS PATH – Importing Packages – Interfaces.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Introduction to C++ - Input and Output Declarations in C++ - Namespaces	Direct instruction(PPT)	Write a C++ programs using inline function.
Week 2	Function Prototypes . Inline Functions	Interactive instruction(PPT)	Write a C++ programs using default arguments.
Week 3	Default Arguments- Unary Scope Resolution Operator.	Direct instruction (PPT and Demonstration)	Write a C++ program using Scope resolution operator.
Week 4	Introduction Comparing class with Structure: Class Scope	Direct instruction (Demonstration)	To learn about OOP Concepts.
Week 5	Accessing Members of a class. Constructor - Destructor	Direct instruction (PPT)	Write a C++ program using Constructor function and Destructor function.

Week 6	Passing and Returning Objects from Functions- Friend Class and Friend function.	Direct instruction (Demonstration)	Write a C++ program using Friend function and Friend class.
Week 7	Operator Overloading Fundamentals – Restrictions- Overloading stream Insertion and Stream Extraction Operators	Direct instruction (Demonstration)	To learn about operator overloading.
Week 8	Overloading Unary, Binary Operators.	Direct instruction (PPT)	Write a C++ program using Unary, Binary Operators.
Week 9	Inheritance Introduction Types - Protected Members Public - Protocols and Private Inheritance - Direct Base Classes and Indirect Base Classes.	Direct instruction(PPT)	Write a C++ programs using inheritance.
Week 10	History of Java- Java Buzzwords - Data Types Variables - Scope and Life Time Of Variables - Arrays - Operators- Expressions	Direct instruction (Demonstration)	Write a Java program using Class and Objects .
Week 11	Control Statements - Type Conversion and Casting - Simple Java Program	Direct instruction (Demonstration)	Write a Java program using Overloading method.
Week 12	Concepts of Classes Objects Constructors Methods - Access Control- This Keyword - Garbage Collection - Overloading Methods and Constructors - Parameter Passing- Recursion - Nested and Inner Classes- Exploring String Class.	Direct instruction (Demonstration)	Write a Java program using Overriding method.
Week 13	Forms of Inheritance- Class Hierarchy- Benefits of Inheritance - Member Access Rules -Super Uses - Using Final With Inheritance	Direct instruction (Demonstration)	Write a Java program using Single Inheritance .
Week 14	Polymorphism- Method Overriding - Abstract Classes - Defining - Creating And Accessing A Package	Direct instruction (PPT)	Write a Java program using Mutiple Inheritance
Week 15	Understanding CLASS PATH – Importing Packages – Interfaces.	Direct instruction (PPT)	To learn about Package Concepts

EXPERIMENTS:

1. Write a C++ program using Scope resolution operator.
2. Write a C++ programs using inline function.
3. Write a C++ programs using Constructor function.
4. Write a C++ programs using Destructor function.
5. Write a C++ programs using Friend function.
6. Write a C++ programs using Friend class.
7. Write a Java program using Class and Objects .
8. Write a Java program using Overloading method.
9. Write a Java program using Overriding method.
10. Write a Java program using Multiple Inheritance concepts.

TEXT BOOK(S):

1. E.Balagurusamy, Object-Oriented Programming Using C++ , Mcgraw Hill Education, 8th Edition, 2020.
2. Herbert Schildt,Java The complete reference, 11th Edition, McGraw Hill Education, 2019.

REFERENCES:

1. D.S.Malik, C++ Programming Language, CENGAGE Learning, 2009.
2. Bjarne Struoustrup, The C++ Programming Language , Addison Wesley, 2000.

2.4 214CSE2304: NETWORK PROGRAMMING

214CSE2304	Network Programming	L 2	T 0	P 2	X 0	C 3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the concepts to build a network.
- To describe the multimedia networking.
- To analyze the concepts of network management.
- To apply the multi-node setup environment.
- To understand the concepts of IP-IN-IP Encapsulation.

COURSE OUTCOMES:

CO1: Understand the concepts to build a network.

CO2: Describe the multimedia networking.

CO3: Analyze the concepts of network management.

CO4: Apply the multi-node setup environment.

CO5: Understand the concepts of IP-IN-IP Encapsulation.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			M		M	M				M	
CO2			S							S		
CO3	M	M		S								L
CO4								S	S	M	S	S
CO5				S	S							

UNIT I: BUILDING A NETWORK

Requirements – connectivity –cost effective resource sharing – Support for common services – Network architecture - Internet architecture – Layering and Protocols – Implementing network software – Example application – Protocol implementation issues – Performance – Bandwidth and Latency – Delay – Bandwidth product – Application Performance needs.

UNIT II: MULTIMEDIA NETWORKING

Multimedia networking applications – Hurdles for multimedia in today's internet – Audio and video compression – Streaming stored Audio and Video – Real Time Streaming Protocol – Making the Best of the Best-Effort service – An Internet phone example – Removing jitter at the receiver for audio – Beyond Best Effort - Protocols for Real- Time interactive Applications.

UNIT III: NETWORK MANAGEMENT

Overview of network management – Infrastructure for network management – Internet Standard Management Framework – Structure of Management Information – Management Information Base – security and administration

UNIT IV: MULTI-NODE SETUP ENVIRONMENT

Setup multi-node cluster of virtual machines on your machine – Local and remote subnets – Layer 3 route semantics – Configure layer 3 routes in nodes – Dynamic construction of L3 routing table – Neighbotship database management – Creation of Link state database – Shortest path first algorithm – calculation of final routing table.

UNIT V: IP-IN-IP ENCAPSULATION

Need - Definition of IP-IN-IP Encapsulation – Routing of Encapsulated packet – scenarios – TLVs –Need – TLV decoder – Benefits – How ping works – ICMP protocol description – networking applications – troubleshooting utilities – wireshark –tcpdump – Router to Vlan forwarding - Concept of SVI interfaces - SVI –Vlan binding - Inter vlan routing.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Requirements – connectivity –cost effective resource sharing – Support for common services – Network architecture - Internet architecture	Direct instruction(PPT)	To implement the L2 routing concepts

Week 2	Layering and Protocols – Implementing network software – Example application – Protocol implementation issues	Interactive instruction(PPT)	To implement the L3 routing concepts
Week 3	Performance – Bandwidth and Latency – Delay – Bandwidth product – Application Performance needs.	Direct instruction(Videos)	Understand the procedure of Dynamic construction of L3 Routing Table
Week 4	Multimedia networking applications – Hurdles for multimedia in today's internet – Audio and video compression – Streaming stored Audio and Video	Explicit Teaching	To study the Networking devices functioning - L2 switch
Week 5	Real Time Streaming Protocol – Making the Best of the Best-Effort service – An Internet phone example	Flipped Learning	To implement HTTP webservers
Week 6	Removing jitter at the receiver for audio – Beyond Best Effort - Protocols for Real- Time interactive Applications.	Case Study based Learning	To learn the concepts of TLVs
Week 7	Overview of network management – Infrastructure for network management	Explicit Teaching	To implement the concept of packet encapsulation.
Week 8	Internet Standard Management Framework – Structure of Management Information	Problem solving	To implement VLANs and Routing in VLANs.
Week 9	Management Information Base – security and administration	Direct instruction(PPT)	To learn Broadcast domain and collision domain.
Week 10	Setup multi-node cluster of virtual machines on your machine – Local and remote subnets – Layer 3 route semantics – Configure layer 3 routes in nodes	Flipped Learning	To learn the SVI interfaces.
Week 11	Dynamic construction of L3 routing table – Neighbotship database management – Creation of Link state database	Case Study based Learning	Implementation of Ping service

Week 12	Shortest path first algorithm – calculation of final routing table.	Direct instruction(PPT)	Demonstration of Non-Blocking I/O
Week 13	Need - Definition of IP-IN-IP Encapsulation – Routing of Encapsulated packet – scenarios – TLVs –Need – TLV decoder – Benefits – How ping works	Direct instruction(PPT)	Implementation of concurrent chat server that allows current logged in
Week 14	ICMP protocol description – networking applications – troubleshooting utilities – wireshark –tcpdump	Interactive instruction(PPT)	Build a concurrent multithreaded file transfer server using threads
Week 15	Router to Vlan forwarding - Concept of SVI interfaces - SVI –Vlan binding - Inter vlan routing.	Direct instruction(PPT)	Implementation Of GUI With AWT

EXPERIMENTS:

1. To implement the L2 routing concepts
2. To implement the L3 routing concepts
3. Understand the procedure of Dynamic construction of L3 Routing Table
4. To study the Networking devices functioning - L2 switch
5. To implement HTTP webservers
6. To learn the concepts of TLVs
7. To implement the concept of packet encapsulation.
8. To implement VLANs and Routing in VLANs.
9. To learn Broadcast domain and collision domain.
10. To learn the SVI interfaces.
11. Implementation of Ping service
12. Demonstration of Non-Blocking I/O
13. Implementation of concurrent chat server that allows current logged in
14. Build a concurrent multithreaded file transfer server using threads
15. Implementation Of GUI With AWT

TEXT BOOK(S):

1. Dr. Parminder Singh , Foundation of Network Programming, 2019.

REFERENCES:

1. Jason Edelman , Scott S. Lowe , Matt Oswalt, Network Programmability and Automation: Skills for the Next-Generation Network Engineer, 1st Edition, 2018.

2.5 214CSE2305: CLOUD COMPUTING

214CSE2305	Cloud Computing	L 2	T 0	P 2	X 0	C 3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the IaaS, PaaS and SaaS.
- To analyze various scheduling techniques for virtual machines and emerging technologies in cloud infrastructure.
- To implement private/public/hybrid Cloud infrastructure and components of cloud computing.
- To design of data security techniques in the Cloud Computing.
- To implement IBM cloud.

COURSE OUTCOMES:

CO1: Understand the IaaS, PaaS and SaaS

CO2: Analyze various scheduling techniques for virtual machines in cloud infrastructure.

CO3: Implement private/public/hybrid Cloud infrastructure.

CO4: Design of data security techniques in the Cloud Computing.

CO5: Implement IBM cloud.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			M		M	M				M	
CO2			S							S		
CO3	M	M		S								L
CO4								S	S	M	S	S
CO5				S	S							

UNIT I: OVERVIEW OF CLOUD COMPUTING

Introduction to Cloud Computing - Definition - Characteristics - Components – Cloud Provider - SAAS - PAAS - IAAS And Others - Organizational Scenarios of Clouds - Administering Monitoring Cloud Services - Benefits and Limitations - Deploy Application Over Cloud - Comparison among SAAS - PAAS - IAAS Cloud Computing Platforms

UNIT II: CLOUD ADOPTION AND EMERGING TECHNOLOGIES

Business case for cloud computing- Emerging technologies – AI, IOT, Analytics - Data in the Cloud: Relational Databases - Cloud File Systems: GFS And HDFS - Bigtable - Hbase and Dynamo. Map-Reduce And Extensions: Parallel Computing – The Map-Reduce Model - Parallel Efficiency of Map-Reduce - Relational Operations Using Map-Reduce - Enterprise Batch Processing Using Map-Reduce.

UNIT III: COMPONENTS OF CLOUD COMPUTING

Cloud security fundamentals - Vulnerability Assessment Tool for Cloud - Identity Management and Access Control-Identity Management - Access Control - Autonomic Security Cloud Computing Security Challenges: Virtualization Security Management- Virtual Threats - VM Security Recommendations - VM-Specific Security Techniques - Secure Execution Environments and Communications In Cloud.

UNIT IV: SECURITY

Issues in Cloud Computing - Implementing Real Time Application over Cloud Platform - Issues in Intercloud Environments - QOS Issues in Cloud - Dependability - Data Migration - Streaming in Cloud. Quality Of Service (Qos) Monitoring in A Cloud Computing Environment - Cloud Middleware - Mobile Cloud Computing - Inter Cloud Issues – A Grid Of Clouds - Sky Computing.

UNIT V: IBM CLOUD

Next generation hybrid multi-cloud platform – Advanced data – AI capabilities – IBM cloud hybrid solutions – cloud native applications – Migrate workloads to cloud – DevOps – 5G – edge computing – serverless – microservices – Application modernization – Virtual Private Cloud – Features – benefits –three-tier architecture – Pricing - VPC and IBM cloud.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Introduction to Cloud Computing,Definition, Characteristics,Components, Cloud Provider	Direct instruction(PPT)	To study business case for cloud computing.

Week 2	SAAS, PAAS, IAAS And Others, Organizational Scenarios of Clouds, Administering Monitoring Cloud Services	Interactive instruction(PPT)	To create an account on IBM cloud
Week 3	Benefits and Limitations,Deploy Application Over Cloud,Comparison among SAAS - PAAS - IAAS Cloud Computing Platforms.	Direct instruction(Videos)	To implement deployment models of cloud
Week 4	Business case for cloud computing, Emerging technologies – AI, IOT, Analytics	Explicit Teaching	To study about serverless computing
Week 5	Data in the Cloud: Relational Databases, Cloud File Systems: GFS And HDFS,Bigtable, Hbase and Dynamo. Map-Reduce And Extensions: Parallel Computing,The Map-Reduce Model	Flipped Learning	To implement hybrid clouds
Week 6	Parallel Efficiency of Map-Reduce, Relational Operations Using Map-Reduce,Enterprise Batch Processing Using Map-Reduce.	Case Study based Learning	To learn about Microservices.
Week 7	Cloud security fundamentals, Vulnerability Assessment Tool for Cloud,Identity Management and Access Control	Explicit Teaching	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
Week 8	Autonomic Security Cloud Computing Security Challenges: Virtualization Security Management,Virtual Threats	Problem solving	Find a procedure to transfer the files from one virtual machine to another virtual machine.
Week 9	VM Security Recommendations,VM-Specific Security Techniques,Secure Execution Environments and Communications In Cloud.	Direct instruction(PPT)	To install and configure own cloud.

Week 10	Issues in Cloud Computing,Implementing Real Time Application over Cloud Platform,Issues in Intercloud Environments,QOS Issues in Cloud,Dependability, Data Migration	Flipped Learning	To implement virtualization in cloud computing.
Week 11	Streaming in Cloud. Quality Of Service (Qos) Monitoring in A Cloud Computing Environment	Case Study based Learning	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
Week 12	Cloud Middleware,Mobile Cloud Computing, Inter Cloud Issues,A Grid Of Clouds,Sky Computing.	Direct instruction(PPT)	Find a procedure to launch virtual machine using trystack.
Week 13	Next generation hybrid multi-cloud platform,Advanced data,AI capabilities,IBM cloud hybrid solutions,cloud native applications,Migrate workloads to cloud	Direct instruction(PPT)	Install Hadoop single node cluster and run simple applications like wordcount.
Week 14	DevOps,5G,edge computing,serverless, microservices,Application modernization	Interactive instruction(PPT)	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
Week 15	Virtual Private Cloud,Features, benefits, three-tier architecture,Pricing,VPC and IBM cloud.	Direct instruction(PPT)	Use GAE launcher to launch the web applications.

EXPERIMENTS:

1. To study business case for cloud computing.
2. To create an account on IBM cloud
3. To implement deployment models of cloud
4. To study about serverless computing
5. To implement hybrid clouds
6. To learn about Microservices.

7. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
8. Find a procedure to transfer the files from one virtual machine to another virtual machine.
9. To install and configure own cloud.
10. To implement virtualization in cloud computing.
11. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
12. Find a procedure to launch virtual machine using trystack.
13. Install Hadoop single node cluster and run simple applications like wordcount.
14. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
15. Use GAE launcher to launch the web applications.

TEXT BOOK(S):

1. Stephen Orban, Andy Jassy, Adrian Cockcroft, Mark Schwartz , Ahead in the Cloud: Best Practices for Navigating the Future of Enterprise IT, CreateSpace Independent Publishing Platform; 1st edition, 2018.

REFERENCES:

1. Michael J. Kavis , Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS), Wiley, 1st Edition, Kindle Edition, 2014.

2.6 214CSE2306: ANDROID PROGRAMMING

214CSE2306	ANDROID PROGRAMMING	L	T	P	X	C
		2	0	2	0	3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand Android SDK..
- To gain a basic understanding of Android Application Development.
- To design the basic level application using Android SDK.

COURSE OUTCOMES:

CO1: Understand the basics of android application development environment.

CO2: Build their ability to develop software with reasonable complexity on mobile platform.

CO3: Analyze the basics of android User Interface.

CO4: Discover the life cycles of Activities, Applications, intents and fragments.

CO5: Design the Android apps for real time problem.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S	L	L	M			M					L
CO2	S	S	M								L	
CO3	S	M	M	L	M	L	L			M	M	L
CO4	S	M	M						L	L	L	M
CO5	S	M	M	M	M	M	L	L		M	M	L

UNIT I: INTRODUCTION ANDROID PROGRAMMING

Features of Android, Architecture of Android, Android Devices in the Market, Android SDK, Installing the Android SDK Tools, Configuring the Android SDK Manager, Eclipse, Android Development Tools (ADT), Creating Android Virtual Devices (AVDs), Creating Your First Android Application, Anatomy of an Android Application.

UNIT II: ANDROID USER INTERFACE

Understanding the Components of a Screen, Views and ViewGroups, LinearLayout, AbsoluteLayout, TableLayout, RelativeLayout, FrameLayout, ScrollView, Adapting to Display Orientation, Anchoring Views, Resizing and Repositioning, Managing Changes to Screen Orientation, Persisting State Information during Changes in Configuration, Detecting Orientation Change, Controlling the Orientation of the Activity.

UNIT III: DESIGNING YOUR USER INTERFACE WITH VIEWS

Using Basic Views, TextView View, Button, ImageButton, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup Views, ProgressBar View,Using Picker Views, Using List Views to Display Long Lists, Using the Spinner View, Using Image Views to Display Pictures, Gallery and ImageView Views, ImageSwitcher, GridView, Using Menus with Views.

UNIT IV: DATA PERSISTENCE

Saving and Loading User Preferences, Accessing Preferences Using an Activity, Programmatically Retrieving and Modifying the Preferences Values, Persisting Data to Files, Creating and Using Databases, Creating the DBAdapter Helper Class, Using the Database Programmatically , Pre-Creating the Database.

UNIT V: APPLICATION DEVELOPMENT

Building Application(IOS, Window, Android).- App structure, built-in Controls, file access, basic graphics Android/iOS/Win8 inbuilt APP- DB access, network access, contacts/photos. Native level programming on Android -Low-level programming on (jailbroken) iOS-Windows low level APIs.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Features of Android, Architecture of Android, Android Devices in the Market, Android SDK, Installing the Android SDK Tools	PPT, Demonstration	Installing Andriod Studio on Windows
Week 2	Configuring the Android SDK Manager, Eclipse, Android Development Tools (ADT), Creating Android Virtual Devices (AVDs)	Demonstration, PPT,Videos	Create “Hello World” application. That will display “Hello World” in the middle of the screen using TextView Widget in the yellow color
Week 3	Creating Your First Android Application, Anatomy of an Android Application.	PPT,Case Study-based Learning	i) Create application for demonstration of android activity life cycle . ii) Create Registration page to demonstration of Basic widgets available in android.
Week 4	Understanding the Components of a Screen, Views and ViewGroups, LinearLayout, Abso- luteLayout, TableLayout, RelativeLayout, FrameLayout, ScrollView	PPT	Using Android, Create a login Activity. It asks “username” and “password” from user. If username and password are valid, it displays Welcome message using new activity.
Week 5	Adapting to Display Orientation, Anchoring Views, Resizing and Repositioning, Managing Changes to Screen Orientation	PPT, Videos	i) Create an application for demonstration of Relative and Table Layout in android. ii) “Independence Day ” App using TextView and ImageView.
Week 6	Persisting State Information during Changes in Configuration, Detecting Orientation Change, Controlling the Orientation of the Activity	PPT	Create “Hello Toast” App by implementing a click handler method for the button to display a message on the screen when the user clicks. Use Linear Layout for creating view.

Week 7	Using Basic Views, TextView View, Button, ImageButton, EditText, CheckBox, Toggle- Button, RadioButton	PPT, Case Study-based Learning	i) Create an application for demonstration of Scroll view in android. ii) Create an application that will pass two number using TextView to the next screen , and on the next screen display sum of that number
Week 8	RadioGroup Views, ProgressBar View,Using Picker Views, Using List Views to Display Long Lists, Using the Spinner View	Case Study-based Learning, Problem solving, PPT	Create an application that will have spinner with list of animation names. On selecting animation name, that animation should affect on the images displayed below
Week 9	Using Image Views to Display Pictures, Gallery and ImageView Views, ImageSwitcher, GridView, Using Menus with Views	PPT, Demonstration	Create a list of all courses in your college and on selecting a particular course teacher-incharge of that course should appear at the bottom of the screen
Week 10	Saving and Loading User Preferences, Accessing Preferences Using an Activity.	PPT, Case Study-based Learning	Create an application with three option buttons, on selecting a button colour of the screen will change.
Week 11	Programmatically Retrieving and Modifying the Preferences Values, Persisting Data to Files, Creating and Using Databases.	PPT, Demonstration	Saving Data to Internal Storage as files
Week 12	Creating the DBAdapter Helper Class, Using the Database Programmatically , Pre-Creating the Database	PPT,Videos	Student database using SQlite
Week 13	Building Application(IOS, Window, Android).- App structure, built-in Controls, file access.	PPT, Flipped Learning	Create an application to Create, Insert, update, Delete and retrieve operation on the database
Week 14	Basic graphics Android/iOS/Win8 inbuilt APP- DB access, network access, contacts/photos	PPT, Videos, Demonstration	Develop a native application that uses GPS location information

Week 15	Native level programming on Android -Low-level programming on (jailbroken) iOS-Windows low level APIs.	PPT, Case Study-based Learning	Design a society based Android Application.

EXPERIMENTS:

1. Installing Andriod Studio on Windows.

2. Create "Hello World" application. That will display "Hello World" in the middle of the screen using TextView Widget in the yellow color.

3. i) Create application for demonstration of android activity life cycle .
   ii) Create Registration page to demonstration of Basic widgets available in android.

4. Using Android, Create a login Activity. It asks "username" and "password" from user. If username and password are valid, it displays Welcome message using new activity.

5. i) Create an application for demonstration of Relative and Table Layout in android.
   ii) "Independence Day " App using TextView and ImageView.

6. Create "Hello Toast" App by implementing a click handler method for the button to display a message on the screen when the user clicks. Use Linear Layout for creating view.

7. i) Create an application for demonstration of Scroll view in android.
   ii) Create an application that will pass two number using TextView to the next screen , and on the next screen display sum of that number.

8. Create an application that will have spinner with list of animation names. On selecting animation name, that animation should affect on the images displayed below.

9. Create a list of all courses in your college and on selecting a particular course teacher-incharge of that course should appear at the bottom of the screen.

10. Create an application with three option buttons, on selecting a button colour of the screen will change.

11. Saving Data to Internal Storage as files.

12. Student database using SQlite.

13. Create an application to Create, Insert, update, Delete and retrieve operation on the database.

14. Develop a native application that uses GPS location information.

15. Design a society based Android Application.

TEXT BOOK(S):

1. Wei-Meng Lee, Beginning Android 4 Application Development March 2012.

2. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK3 for Dummies,Wiley 2011.

REFERENCES:

1. Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wrox 2012.

2. Charlie Collins, Michael Galpin and Matthias Kappler, Android in Practice, Dream Tech. 2012.

3. James Dovey and Ash Furrow, Beginning Objective C, Apress, 2012.

4. David Mark, Jack Nutting, Jeff LaMouche, and Fredric Olsson, Beginning iOS Development: Exploring the iOS SDK, Apress, 2013.

2.7 214CSE3307: DATA ANALYTICS WITH R

214CSE3307	Data Analytics With R	L 2	T 0	P 2	X 0	C 3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- In this course students will learn R. Programming language,data analytics, data visualisation and statistical model for data analytics.
- By completion of this course, students will be able to become data analyst.

COURSE OUTCOMES:

CO1: Understand the concepts of Various Analytics Techniques.

CO2: Analyze the various concepts of R Programming Basics.

CO3: Understand and apply the concepts of getting data of different types into R.

CO4: Create various paradigms of Visualizations using R.

CO5: Analyze the various concepts of decision trees Statics in R.

MAPPING OF COURSE OUTCOMES WITH PO:

PO'S												
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			M		M	M				M	
CO2								L	M			
CO3	M	S		S						M		L
CO4			S									
CO5				S	M				M			

UNIT I: Introduction to Data Analytics

Overview of Data Analytics, Need of Data Analytics, Nature of Data, Types of data and data Analytics- Characteristics of Data, Applications of Data Analytics.Business Intelligence and Analytics, Business Analytics Optimization.

UNIT II: R Programming Basics

Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.

UNIT III: Getting data into R:

Introduction to Reading and getting data into R (External Data)-Using CSV files, XML files, Web Data, JSON files, Databases, Excel files.

UNIT IV: Working with R Charts and Graphs

Introduction to Working with R Charts and Graphs- Histograms, Boxplots, Bar Charts, Line Graphs, Scatter plots, Pie Charts.

UNIT V: Statistics with R

Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression, Survival Analysis.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Overview of Data Analytics, Need of Data Analytics, Nature of Data, Types of data and data Analytics.	Direct instruction(PPT)	Write a R program greatest among 3 numbers using if and else Statement.
Week 2	Characteristics of Data, Applications of Data Analytics.	Direct instruction(PPT)	Write a R program to generate the even number from 1 to 30 using loop statement.
Week 3	Business Intelligence and Analytics, Business Analytics Optimization.	Direct instruction (PPT)	Write a R program to calculate factorial of a number using function.
Week 4	Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types,	Direct instruction(PPT)	Write a R program to create user defined functions to perform bubble sort using array.
Week 5	Control Structures, Array, Matrix, Vectors, Factors.	Direct instruction (PPT)	Write a R program to create user defined functions to perform selection sort using array.

Week 6	Functions, R packages.	Direct instruction(PPT)	Write a R program to create user defined functions to perform binary search on numeric vector using array .
Week 7	Introduction to Reading and getting data into R (External Data)-Using CSV files, XML files.	Direct instruction(PPT)	Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars and cars datasets.
Week 8	Web Data, JSON files.	Direct instruction (PPT)	Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.
Week 9	Databases, Excel files.	Direct instruction(PPT)	READING AND WRITING DIFFERENT TYPES OF DATASETS A.Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
Week 10	Introduction to Working with R Charts and Graphs.	Direct instruction(PPT)	READING AND WRITING DIFFERENT TYPES OF DATASETS b. Reading Excel data sheet in R.
Week 11	Histograms, Boxplots, Bar Charts.	Direct instruction(PPT)	READING AND WRITING DIFFERENT TYPES OF DATASETS c. Reading XML dataset in R
Week 12	Line Graphs, Scatter plots, Pie Charts.	Direct instruction(PPT)	VISUALIZATIONS a. Find the data distributions using box and scatter plot.
Week 13	Random Forest, Decision Tree,	Interactive instruction (Problem solving)	VISUALIZATIONS b. Plot the histogram, bar chart and pie chart on sample data.

Week 14	Normal and Binomial distributions, Time Series Analysis	Interactive instruction (Problem solving)	REGRESSION MODEL Import a data from web storage. Name the dataset and perform Logistic Regression to find out the relation between variables that are affecting the admission of a student in a institute based on his/her GRE score, GPA, GPA obtained and rank of the student. Project the accuracy of the model.
Week 15	Linear and Multiple Regression, Logistic Regression, Survival Analysis.	Interactive instruction (Problem solving)	REGRESSION MODEL Import a data from web storage. Name the dataset and perform Logistic Regression to find out the relation between variables that are affecting the admission of a student in a institute based on his/her GRE score, GPA, GPA obtained and rank of the student. Project the accuracy of the model.

TEXT BOOK(S):

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team, 2008.

REFERENCES:

1. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2018.

2. Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall, 2000.

3. G Casella and R.L. Berger, Statistical Inference, Thomson Learning, Second Edition 2002.

2.8 214CSE3308: INTRODUCTION TO CYBER SECURITY

214CSE3308	Introduction to Cyber Security	L 2	T 0	P 2	X 0	C 3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Understand Key terms and concepts in Cryptography.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.

COURSE OUTCOMES:

CO1: Understand the basic concepts of security, computer crime and attacks.

CO2: Learn security policies and forensics computation.

CO3: Analyze the crimes and securities/attacks.

CO4: Implement the securities.

CO5: Discover the issues and forensics data.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S	M					M				L	
CO2	S	S	L			M		M				M
CO3	S	S	S	L	M				M	M	L	
CO4	S	S	S			L	L				M	L
CO5	S	L	M		M	M		L	L			M

UNIT I: INTRODUCTION

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT II: CYBERSPACE AND THE LAW CYBER FORENSICS

Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT III: CYBERCRIME: MOBILE AND WIRELESS DEVICES

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

UNIT IV: CYBER SECURITY: ORGANIZATIONAL IMPLICATIONS

Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT V: PRIVACY ISSUES

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)

Week 1	Basic Cyber Security Concepts, layers of security, Vulnerability,threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat	PPT, Tool Demonstration	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars
Week 2	Motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks	PPT, Tool Demonstration	Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following 1. Observer performance in promiscuous as well as non-promiscous mode. 2. Show that packets can be traced based on different filters.
Week 3	IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy	PPT,Flipped Class Learning	Download and install nmap. Use it with different options to scan open ports,perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc
Week 4	Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy	PPT, Animation	HTTP basics
Week 5	Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email	PPT, Videos	OWASP installation
Week 6	Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing	PPT, Case Studybased Learning	HTML injection

Week 7	Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices	PPT, Demonstration	Login Page SQL injection
Week 8	Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices	PPT, Problem Solving	File inclusion vulnerability
Week 9	Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.	PPT, Demonstration	RFI Remote file inclusion
Week 10	Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing.	PPT, Flipped Class Learning	Path traversal attack or Directory browsing attack
Week 11	Security risks and perils for organizations, social computing and the associated challenges for organizations.	PPT, Videos	CSRF Cross Site Request Forgery
Week 12	Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.	PPT, Videos	Buffer overflow
Week 13	Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks.	PPT, Flipped Learning	Use the Nessus tool to scan the network for vulnerabilities
Week 14	Data linking and profiling, privacy policies and their specifications.	PPT, Demonstration	Firewalls and Intrusion Detection Systems (IDS) - IP Tables

Week 15	Privacy policy languages, privacy in different domains- medical, financial, etc.	PPT, Demonstration	Firewalls Bypassing

EXPERIMENTS:

1. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.

2. Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following
   i) Observer performance in promiscuous as well as non-promiscous mode.
   ii) Show that packets can be traced based on different filters.

3. Download and install nmap. Use it with different options to scan open ports,perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc

4. HTTP basics

5. OWASP installation

6. HTML injection

7. Login Page SQL injection

8. File inclusion vulnerability

9. RFI Remote file inclusion

10. Path traversal attack or Directory browsing attack

11. CSRF Cross Site Request Forgery

12. Buffer overflow

13. Use the Nessus tool to scan the network for vulnerabilities

14. Firewalls Intrusion Detection Systems (IDS) - IP Tables

15. Firewalls Bypassing

TEXT BOOK(S):

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.

2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press TF Group.

2.9 214CSE3309: INTRODUCTION TO MACHINE LEARNING

214CSE3309	Introduction to Machine Learning	L	T	P	X	C
		2	0	2	0	3
Pre-requisite :NIL **Course Category :**University Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Prepare the students to understand and gain the knowledge about Machine Learning and statistical modelling
- Gain knowledge on various machine learning algorithms and apply the same on real time data extracted from confined sources.
- Familiarise the students with Python programming packages pertaining to Machine Learning.

COURSE OUTCOMES:

CO1: Understand the concepts and paradigms of machine learning.

CO2: Apply the regression models on continuous data and analyse the efficiency.

CO3: Apply the classification models on discrete data and analyse the efficiency.

CO4: Apply clustering algorithms over the data with appropriate pre-processing.

CO5: Understand and create machine learning models for real time data, appropriate to the given application.

MAPPING OF COURSE OUTCOMES WITH PO:

PO'S												
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L	L										
CO2	S	S	S	S								M
CO3	S	S	S	S								M
CO4	S	S	S	S								M
CO5	S	S	S	S	M	L	L	L	S	L	L	M

UNIT I:INTRODUCTION TO MACHINE LEARNING

The Origins of Machine Learning, Uses and Abuses of Machine Learning – Abstraction and Knowledge Representation, Generalization, Assessing the Success of Learning, Steps to Apply Machine Learning to Data, choosing a Machine Learning Algorithm -Thinking about the Input Data, Thinking about Types of Machine Learning Algorithms.

UNIT II: SIMPLE LINEAR REGRESSION AND MODEL BUILDING

Introduction to Simple Linear Regression, Simple Linear Regression Model Building, Validation of Simple Linear Regression Model, Coefficient of Determination(R-squared) and Adjusted R-Squared, Hypothesis Test for Regression Coefficients (t-Test), Test for Overall Model: Analysis of Variance (F-Test).

UNIT III: CLASSIFICATION ALGORITHMS

Introduction to Classification, General Approach to Classification, Data Distribution, k-Nearest Neighbour Algorithm, Logistic Regression, Decision Trees, Naive Bayesian Classifier Random Forests.

UNIT IV: CLUSTERING ALGORITHMS

Introduction to Clustering, Characteristics of Data for Clustering, Types of Clustering, Partitioning Methods, k Means Clustering, Gap Analysis, k Medoids Clustering, Hierarchical Clustering – Agglomerative and Divisive Clustering.

UNIT V: APPLICATIONS

Machine Learning in Banking and Security – Machine Learning in Communication, Media and Entertainment, Healthcare and Life Sciences – Machine Learning in Education – Machine Learning in Government and Insurance.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	The Origins of Machine Learning, Uses and Abuses of Machine Learning	Direct instruction(PPT)	Hands-on session for Introduction to Machine Learning Concepts.
Week 2	Abstraction and Knowledge Representation, Generalization, Assessing the Success of Learning.	Direct instruction(PPT)	Hands-on session for Steps to Apply Machine Learning to Data, choosing a Machine Learning Algorithm.

Week 3	Thinking about the Input Data.	Direct instruction (PPT)	Hands-on session for Thinking about Types of Machine Learning Algorithms.
Week 4	Introduction to Simple Linear Regression, Simple Linear Regression Model Building.	Direct instruction(PPT)	Program to demonstrate Simple Linear Regression.
Week 5	Validation of Simple Linear Regression Model.	Direct instruction (PPT)	Program to demonstrate Logistic Regression.
Week 6	Coefficient of Determination(R-squared) and Adjusted R-Squared, Hypothesis Test for Regression Coefficients (t-Test).	Direct instruction(PPT)	Hands-on session for Test for Overall Model: Analysis of Variance (F-Test).
Week 7	Introduction to Classification, General Approach to Classification, Data Distribution.	Direct instruction(PPT)	Program to demonstrate k-Nearest Neighbor classification.
Week 8	k-Nearest Neighbour Algorithm, Logistic Regression, Decision Trees.	Direct instruction (PPT)	Program to demonstrate Decision Tree Algorithm.
Week 9	Naive Bayesian Classifier Random Forests.	Direct instruction(PPT)	Program to demonstrate Random Forest Classifier.
Week 10	Introduction to Clustering, Characteristics of Data for Clustering.	Direct instruction(PPT)	Program to demonstrate k-means clustering algorithm.
Week 11	Types of Clustering, Partitioning Methods, k Means Clustering.	Direct instruction(PPT)	Program to demonstrate k-medoids clustering algorithm.
Week 12	Gap Analysis, k Medoids Clustering, Hierarchical Clustering – Agglomerative and Divisive Clustering.	Direct instruction(PPT)	Program to demonstrate hierarchical agglomerative clustering algorithm.
Week 13	Machine Learning in Banking and Security	Direct instruction(PPT)	Hands-on session for Machine Learning in Communication.
Week 14	Media and Entertainment,	Direct instruction (PPT)	Hands-on session for Healthcare and Life Sciences.
Week 15	Machine Learning in Education .	Direct instruction (PPT)	Hands-on session for Machine Learning in Government and Insurance.

EXPERIMENTS:

1. Program to demonstrate Simple Linear Regression.
2. Program to demonstrate Logistic Regression.
3. Program to demonstrate k-Nearest Neighbor classification.
4. Program to demonstrate Decision Tree Algorithm.
5. Program to demonstrate Random Forest Classifier.
6. Program to demonstrate k-means clustering algorithm.
7. Program to demonstrate k-medoids clustering algorithm.
8. Program to demonstrate hierarchical agglomerative clustering algorithm.

TEXT BOOK(S):

1. Atul Kahate, Introduction to Database Management Systems, Pearson Education,New Delhi, 2006.
2. Tom Mitchell, Machine Learning, Tom Mitchell, McGraw Hill, 1997.

REFERENCES:

1. P. Flach, Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press, 2012.
2. C2. M. Mohri, A. Rostamizadeh, and A. Talwalkar, Foundations of Machine Learning,MIT Press, 2012 .

2.10 214CSE4310: ETHICAL HACKING

214CSE4310	Ethical Hacking	L	T	P	X	C
		2	0	2	0	3
Pre-requisite : NIL						
Course Category : University Elective						
Course Type : Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the need of Ethical Hacking .
- To demonstrate the social engineering attacks .
- To implement the various attacks and vulnerabilities.
- To design the tools and techniques to prevent hacking .
- To analyze the various malwares.

COURSE OUTCOMES:

CO1: Understand the need of Ethical Hacking

CO2: Demonstrate the social engineering attacks

CO3: Implement the various attacks and vulnerabilities

CO4: Design the tools and techniques to prevent hacking

CO5: Analyze the various malwares.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S			M		M	M				M	
CO2			S							S		
CO3	M	M		S								L
CO4								S	S	M	S	S
CO5				S	S							

UNIT I: INTRODUCTION OF ETHICAL HACKING

Ethics Of Ethical Hacking:Cyber ethics Hacking –Introduction Why you need to Understand Your Enemy's Tactics?, Recognizing The Gray Areas in Security, Information Gathering, Scanning, Vulnerability Assessment Penetration Testing. Ethical Hacking and the Legal System: Understanding Individual Cyberlaws 18 USC Section 1029, 1030, 2510 Digital Millennium Copyright Act (DMCA) Cyber Security Enhancement Act 2002

UNIT II: SOCIAL ENGINEERING ATTACKS

Social Engineering Attacks: How A Social Engineering Attack Works? Conducting A Social Engineering Attack Common Attacks used in Penetration Testing Defending Against Social Engineering Attacks. Physical Penetration Attacks: Why A Physical Penetration is important Conducting a Physical Penetration Common Ways into A Building. Insider Attacks: Why Simulating an Insider Attack is Important Conducting an Insider Attack Defending against Insider Attack.

UNIT III: CONTENT-TYPE ATTACKS

Understanding and Detecting Content-Type Attacks: How do Content-Type Attacks work? - Which File Formats are Being Exploited Today? - Tools to Detect Malicious PDF Files Tools to test your Protections against Content-Type Attacks How to protect your Environment from Content-Type Attacks. Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities SQL Injection Vulnerabilities Cross-Site Scripting Vulnerabilities. VoIP Attacks

UNIT IV: PASSIVE ANALYSIS

Passive Analysis: Ethical Reverse Engineering Why Bother with Reverse Engineering? Source Code Analysis. Advanced Reverse Engineering: Overview of Software Development Process Instrumentation Tools Fuzzing Instrumented Fuzzying Tools and Techniques. Finding New Browser Based Vulnerabilities. Mitigation Alternatives

UNIT V: MALWARE ANALYSIS

Collecting Malware and Initial Analysis: Malware Latest Trends in Honeynet Technology Catching Malware Initial Analysis of Malware. Hacking Malware: Trends in Malware De-Obfuscating Malware Reverse Engineering Malware. How to hack Wi-Fi?, Webserver,Website

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)

Week 1	Ethics Of Ethical Hacking: Cyber ethics Hacking –Introduction Why you need to Understand Your Enemy's Tactics?, Recognizing The Gray Areas in Security	Direct instruction(PPT)	To learn about hacking tools and skills.
Week 2	Information Gathering, Scanning, Vulnerability Assessment Penetration Testing. Ethical Hacking and the Legal System	Interactive instruction(PPT)	To implement Footprinting and Reconnaissance.
Week 3	Understanding Individual Cyberlaws 18 USC Section 1029, 1030, 2510 Digital Millennium Copyright Act (DMCA) Cyber Security Enhancement Act 2002.	Direct instruction(Videos)	To study about Fingerprinting
Week 4	Social Engineering Attacks: How A Social Engineering Attack Works? Conducting A Social Engineering Attack Common Attacks used in Penetration Testing	Explicit Teaching	To implement system Hacking
Week 5	Defending Against Social Engineering Attacks. Physical Penetration Attacks: Why A Physical Penetration is important	Flipped Learning	To study about Wireless Hacking
Week 6	Insider Attacks: Why Simulating an Insider Attack is Important Conducting an Insider Attack Defending against Insider Attack.	Case Study based Learning	To implement Sniffing and their tools
Week 7	Understanding and Detecting Content-Type Attacks: How do Content-Type Attacks work? - Which File Formats are Being Exploited Today? - Tools to Detect Malicious PDF Files	Explicit Teaching	To learn about basics of Kali linux

Week 8	Tools to test your Protections against Content-Type Attacks How to protect your Environment from Content-Type Attacks. Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities	Problem solving	To implement Wi-Fi penetration testing
Week 9	SQL Injection Vulnerabilities Cross-Site Scripting Vulnerabilities. VoIP Attacks	Direct instruction(PPT)	To learn about Network Hacking – Passive Hacking
Week 10	Passive Analysis: Ethical Reverse Engineering Why Bother with Reverse Engineering? Source Code Analysis. Advanced Reverse Engineering	Flipped Learning	To implement Man in the Middle attack
Week 11	Overview of Software Development Process Instrumentation Tools	Case Study based Learning	To check links on Web sites and sustaining their efficiency
Week 12	Fuzzing Instrumented Fuzzying Tools and Techniques. Finding New Browser Based Vulnerabilities. Mitigation Alternatives	Direct instruction(PPT)	To perform automated computer encryption
Week 13	Collecting Malware and Initial Analysis: Malware Latest Trends in Honeynet Technology Catching Malware Initial Analysis of Malware.	Direct instruction(PPT)	To restrict the resources for an application
Week 14	Hacking Malware: Trends in Malware De-Obfuscating Malware Reverse Engineering Malware.	Interactive instruction(PPT)	To monitor network and capturing data traffic
Week 15	How to hack Wi-Fi?, Webserver,Website.	Direct instruction(PPT)	To implement a code to simulate buffer overflow attack.

EXPERIMENTS:

1. To learn about hacking tools and skills.

2. To implement Footprinting and Reconnaissance.
3. To study about Fingerprinting
4. To implement system Hacking.
5. To study about Wireless Hacking.
6. To implement Sniffing their tools.
7. To learn about basics of Kali linux
8. To implement Wi-Fi penetration testing.
9. To learn about Network Hacking – Passive Hacking
10. To implement Man in the Middle attack
11. To check links on Web sites and sustaining their efficiency
12. To perform automated computer encryption
13. To monitor network and capturing data traffic.
14. To restrict the resources for an application
15. To implement a code to simulate buffer overflow attack.

TEXT BOOK(S):

1. The Hacker Playbook 2: Practical Guide to Penetration Testing, Kindle Edition, Peter Kim, 2014

REFERENCES:

1. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, Terron Williams, Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition, 2011
2. Sharma Pankaj, Hacking, APH Publishing, 2005. Rajat Khare, Network Security and Ethical Hacking, Luniver Press, 2006.

3 PROGRAM CORE

3.1 212CSE1101: IT INFRASTRUCTURE LANDSCAPE OVERVIEW

212CSE1101	IT Infrastructure Landscape Overview	L	T	P	X	C
		4	0	0	0	3
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Theory						

COURSE OBJECTIVES:

- To understand the concepts of IT infrastructure and its components.
- To learn the importance of information assurance and security in the selection, creation, integration and administration of an IT infrastructure.
- To develop conceptual understanding of database management systems.
- To provide a transition from working on a single computer to an entire fleet.

COURSE OUTCOMES:

CO1: Apply skills on server, directory structure and virtualization techniques for computing practice.

CO2: Inspect on the current storage technologies.

CO3: Interpret the different networking technologies and threats.

CO4: Interpret on the IT management technologies and analyse the database concepts.

CO5: Analyse on different applications of middleware services.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			S							M	M	S	
CO2	S	S	S	S	S								S	
CO3	S					S								
CO4	S	S	S	S	S	S	S	S			M	M	S	
CO5	S	S	S	S	S						M	M	S	

UNIT I: Systems Directory Services Overview

Basics, functions - Examples, Virtualization, Hypervisor, Server Deployment, Server Availability Concepts And Techniques, partitioning, Server Workload. Directory Concepts, LDAP PROTOCOL, Overview of LDAP, LDAP Architecture, LDAP Models, LDAP Replication Topologies, LDAP Data Interchange Format (LDIF).

UNIT II: Storage Overview

Storage Networking Technology, Types Of Storage System, FC-AL (Fibre Channel Arbitrated Loop), Fabric, Storage Area Network, Zoning, Storage Virtualization - Backups, Archive, Bare Machine Recovery (BMR) , Retention.

UNIT III: Network Security and Overview

Network Overview, Network Topologies, Tree Topology, Firewalls, Hub, Bridge, Switching Concepts, What Is Routing? , Virtual Lan's, Security Basics, Loss Of Privacy, Loss Of Integrity, Security Technology, Secure Messaging, Data Security, Network Security.

UNIT IV: Database Overview

Understanding Database types, Database Terminology, Characteristics, Introduction To Database Management Systems, Types Of Database Management Systems, Database Security And Recovery, Data Mining, Data Warehousing, And Data Marts, Data Mining (DM), Data Warehousing and Data Marts, SQL Overview , Introduction to SQL, History of SQL, Relational database schema, manipulation with SQL - Selecting, Ordering, Inserting data, Deleting data, Updating data, JDBC and ODBC concepts.

UNIT V: Application and Middleware Overview

Introduction To Common Messaging System (MQ SERIES), Middleware, Message Oriented Middleware, Synchronous interaction, Asynchronous interaction, IBM Websphere MQ, Websphere MQ Objects, Web Tier Deployment, Application Servers And Clustered Deployment, Lotus Architecture, Lotus Domino Server Types, Lotus DATA WAREHOUSING, Warehouse Modeling Approaches , Basic Concepts, Dimension, Basic OLAP Operations.

15 WEEK COURSE PLAN

Week	Lecture (4 hours)	Pedagogy
Week 1	Server Technology basics, need	Explicit Teaching
	Rack, Tower and Blade Server	Explicit Teaching
	Operating System - Basics, functions - Examples	Explicit Teaching
	Server concepts	Tutorial

Week 2	Virtualization, Hypervisor - types, implementation	Explicit Teaching/ Demonstration
	Server Deployment	Explicit Teaching
	Server Availability Concepts and Techniques	Explicit Teaching
	Partitioning, Practice Session - Disk Partitioning	Demonstration
Week 3	Server Workload, Directory Concepts	Explicit Teaching
	LDAP PROTOCOL, Overview of LDAP, LDAP Architecture	Explicit Teaching
	LDAP Models	Explicit Teaching
	LDAP Replication Topologies	Demonstration
Week 4	LDAP Data Interchange Format (LDIF)	Explicit Teaching
	Storage Networking Technology	Explicit Teaching
	Types Of Storage System	Explicit Teaching
Week 5	FC-AL (Fibre Channel Arbitrated Loop)	Explicit Teaching
	Fabric	Explicit Teaching
	Storage Area Network	Explicit Teaching
	Practice Session - Disk Management	Demonstration
Week 6	Zoning	Explicit Teaching/ Demonstration
	Storage virtualization	Explicit Teaching, Problem Solving
	Backups, Archive, Bare Machine Recovery (BMR) , Retention	Explicit Teaching
	Tutorial - Virtualization	Tutorial, Problem Solving
Week 7	Network Overview, Characteristics	Explicit Teaching/ Demonstration
	Network Topologies	Explicit Teaching
	Firewalls	Explicit Teaching
Week 8	Switching Concepts, Hub, Bridge , Routing	Explicit Teaching/ Demonstration
	Virtual Lan's	Explicit Teaching
	Security Basics	Explicit Teaching
	Loss Of Privacy, Loss Of Integrity	Explicit Teaching
Week 9	Security Technology, Active Audit	Flipped Learning

	Secure Messaging, Data Security	Explicit Teaching
	Network Security	Explicit Teaching
	Cryptography, public key and private key	Tutorial
Week 10	Understanding Database types, Database Terminology	Explicit Teaching/ Demonstration
	Types of Database Management Systems, Advantages of Using the DBMS Approach	Explicit Teaching
	Database Security And Recovery	Explicit Teaching
Week 11	Data Mining, Data Warehousing, And Data Marts	Explicit Teaching/ Demonstration
	SQL Overview , Introduction to SQL, History of SQL, Relational database schema a schema	Explicit Teaching
	Data Types, Dates and Times	Demonstration
	Creating a table, Default Values, NULL values	Demonstration
Week 12	Constraints, Referential integrity	Explicit Teaching/ Demonstration
	Creating a view, Creating other database objects, Modifying database objects, Renaming database objects	Explicit Teaching/ Demonstration
	Data manipulation with SQL - Selecting, Ordering, Inserting data, Deleting data, Updating data	Explicit Teaching/ Demonstration
	SQL queries	Practical
Week 13	JDBC and ODBC concepts	Explicit Teaching/ Demonstration
	Introduction To Common Messaging System (MQ SERIES), Middleware concept	Explicit Teaching/ Demonstration
	Data Warehousing, Warehouse Modeling Approaches	Explicit Teaching
	Global data Warehouse Architecture	Explicit Teaching
Week 14	Middleware, Message Oriented Middleware	Explicit Teaching/ Demonstration
	Synchronous interaction, Asynchronous interaction	Explicit Teaching

	Web tier Deployment, OLAP operations	Explicit Teaching
	Middleware technologies	Tutorial
Week 15	IBM Websphere MQ, Websphere MQ Objects	Explicit Teaching/ Demonstration
	Application servers and clustered deployment	Explicit Teaching
	Lotus Architecture, Lotus Domino Server Types, DB2 access views	Demonstration
	IBM Websphere MQ	Tutorial

TEXT BOOK(S):

1. IT Infrastructure Landscape Overview (IBM ICE Publication).

2. Gupta, "IT Infrastructure its Management", First Edition, Tata McGraw-Hill Education.

REFERENCES:

1. R Elmasri and S Navathe, 2012, "Fundamentals of Database Systems", Seventh Edition, Pearson Education.

2. Gilbert Held, 2000, "Server Management (Best Practices Book 9)", 1st Edition, Auerbach Publications.

3. Sangam Racherla, Vikas Bajaj, Emile Knebel, 2010, "IBM Information Infrastructure Solutions", IBM Redbook publisher, International Technical support Organization.

3.2 212CSE2301: DATA STRUCTURES

212CSE2301	DATA STRUCTURES	L 2	T 0	P 2	X 3	C 4
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Identify the systematic way of solving the problems searching techniques
- Understand and evaluate Abstract Data Types and linear data structures
- Design non-linear data structures such as trees and graphs
- Understand the efficiency of various sorting and hashing techniques
- Apply data structure concepts to various examples and real life applications

COURSE OUTCOMES:

CO1: Understand the role of algorithms and programming constructs as a systematic and efficient way of solving problems searching techniques

CO2: Create Abstract Data Types for linear data structures and implement the same.

CO3: Design and implement non-linear data structures such as tree

CO4: Interpret and analyze efficiency of various sorting techniques and hashing

CO5: Design data structures and develop code for real life problems using graphs

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S											S	
CO2	S	S											S	
CO3	S	S	M	L	M								S	M
CO4	S	S	M	L	M								S	M
CO5	S	S	M	L									S	

UNIT I: INTRODUCTION

Basic Terminologies: Elementary Data Organizations, Data Structure, Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques, and their complexity analysis.

UNIT II LINKED LISTS, STACKS AND QUEUES

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. ADT Stack and its operations: Algorithms and their complexity, analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

UNIT III TREES

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree:definitions, algorithms and analysis.

UNIT IV – SORTING AND HASHING

Objective and properties of different sorting algorithms, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort ,Performance and Comparison among all the methods, Hashing

UNIT V - GRAPHS

Basic Terminologies and Representations Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS)- Shortest path algorithms –Floyds, Warshall, Transitive closure, Minimum Spanning Tree, Prims, Kruskals, Topological sorting

X Component

- **S**tudent will reach a minimum of 5000 -10000 points in Hackerrank coding website
- **C**ompletion of course in Coursera “Advanced Data structures ”
- **P**rogramming Assignments with the problems from ProjectEuler and Hackerrank

15 WEEK COURSE PLAN

Week	Lecture (1 hours)	Pedagogy	Practical (2 hours)	X Component (3 hours)
Week 1	Basic Terminologies: Elementary Data Organizations, Data Structure operations : insertion, deletion, traversal,Analysis of an Algorithm	Explicit Teaching	Problem scenario in structures, arrays and pointers	Courseera on data structures using C++ /DS using python
Week 2	Asymptotic Notations, Time-Space trade off,Searching: Linear, Binary Search Techniques, and their complexity analysis.	Explicit Teaching	Problem scenario in searching	Analysis of Problems in terms of time and Space (GATE)
Week 3	ADT Stack and its operations, Applications - Expression Conversion and evaluation, Complexity Analysis	Explicit Teaching	Problem scenario in Stack and its application using arrays	Assignment Submission problem using LIFO and FIFO
Week 4	ADT queue, Types of Queue: Simple, Circular,Priority Queues : Operations on each types of Queues, Complexity Analysis ,	Explicit Teaching	Problem scenario in Queue and types of queue using arrays	Roller-Coaster ride using Queue ADT
Week 5	Singly linked lists: Representation and operations:Traversing, Searching, Insertion into, Deletion from linked list	Explicit Teaching	Problem scenario in linked list operations	Merging L1and L2 without duplicate data in the list, Hackerrank Challenges- I

Week 6	Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis,Circular Linked Lists: all operations their algorithms and the complexity analysis.	Explicit Teaching	Problem scenario in Stack and queue using Linked list and pointers	Implementation of Muti-player board game using linked list concepts in C/ python language, Hackerrank Challenges- II
Week 7	Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search Tree	Explicit Teaching	Problem scenario in Binary search manipulation	Develop an application program for executing all the tree traversal with interactive output
Week 8	Applications of BT, BST, Threaded Binary Trees and its insertion and deletion	Explicit Teaching	Problem scenario in Binary search Tree manipulation	Tree Terminology and its operations(GATE)
Week 9	Height Balanced Trees : AVL Tree and its Rotations	Explicit Teaching	Problem scenario in AVL operations	Indian Railway ticketing system using Red -Black trees
Week 10	B Tree, B+ Tree:definitions, algorithms and analysis	Explicit Teaching	Problem scenario in B+ tree operations	To implement an applications for Auto correctors and spell checker using all tree concepts
Week 11	Objective and properties of different sorting algorithms, Selection Sort, Bubble Sort,Insertion Sort, Quick Sort, Merge Sort	Explicit Teaching	Problem scenario in internal sorting	Apply all sorting techniques for sorting a large data set From your observation and analysis,determine the best sorting technique for working with large numbers
Week 12	Heap Sort, Performance and Comparison of sorting methods, Hashing.	Explicit Teaching	Problem scenario in External sorting	Secure Hashing Algorithm SHA-512

Week 13	Graph -Basic Terminologies and Representations, Traversal algorithms: Depth First Search, (DFS) and Breadth First Search (BFS)	Explicit Teaching	Problem scenario in Graph application and traversal	Implementation of Google Page Rank Algorithm , Search engine crawlers - web page indexing and searching using graph traversal
Week 14	Shortest path algorithms –Dijkstra	Explicit Teaching	Problem scenario in Shortest path	Floyds Warshall algorithm for Shortest Path
Week 15	Minimum Spanning Tree Algorithms -Prim's, Kruskal's Algorithm, Topological sorting	Explicit Teaching	Problem scenario in MST Algorithms	Bellman Ford algorithm

EXPERIMENTS:

1. Programs using structures, arrays, pointers to structures and passing them as parameters to functions.
2. Programs for various types of recursion searching
3. Program for linked list and its operations.
4. Program for array implementation of stack and queue
5. Program for various applications of stack.
6. Program for linked list implementation of stack and queue.
7. Program for binary search tree and its operations
8. Program for various simple sorting techniques: Selection Sort b) Bubble Sort c) Insertion Sort
9. Program for various advanced sorting techniques : a) quick sort b) Merge sort c) Heap sort
10. Program for Dijikstra's shortest path algorithms in graphs
11. Program for finding minimum spanning tree in graphs using Kruskal's and Prim's algorithms
12. Secure Hashing Algorithm SHA-512
13. Bellman Ford algorithm
14. RED black and Splay tree

TEXT BOOK(S):

1. Fundamentals of Data Structures", Third Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press,2010

2. Fundamental Data Structures and Algorithm ,P.Deepalakshmi, Shasi Anand Sridharan ,First Edition, Pearson Education,2019

REFERENCES:

1. Algorithms, Data Structures, and Problem Solving with C++", Third Edition by Mark Allen Weiss, Addison-Wesley Publishing Company ,2011 How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson press,2010

2. Charles Dierbach, Introduction to Computer Science using Python: a computational problem-solving focus, Wiley Publishers,2013

3.3 212CSE2302: DIGITAL PRINCIPLES AND SYSTEM DESIGN

212CSE2302	Digital Principles and System Design	L	T	P	X	C
		2	1	2	0	4
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- On completion of the course delegates will be able to:
- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To identify commonly used integrated circuit families used in digital equipment.
- To prepare students to perform the analysis and design of various digital electronic circuits.
- To Troubleshoot digital circuits using standard test equipment.

COURSE OUTCOMES:

CO1: Demonstrate the simplification of Boolean expressions using Boolean algebra & K-Map method.

CO2: Design combinational digital circuits to meet a given specification and to represent logic functions in multiple forms.

CO3: Illustrate the concept of sequential circuits with its characteristic equation and excitation Table.

CO4: Demonstrate the working of logic families with its characteristics.

CO5: Analyse the role of memory in computer and the different types of memory.

CO6: Identify combinatorial logic circuits and sequential logic circuits, and explain their operation.

CO7: Analyse the performance digital circuits using specialized instruments.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		M												
CO2		M												
CO3		M												
CO4		M	M										M	
CO5	S	M											M	
CO6	S		M										M	
CO7	S		M										M	

UNIT I: Number Systems and Boolean Algebra

Base Conversions, Signed numbers, Fixed and Floating-point Numbers, Basic Arithmetic Operations, Alphanumeric Codes, Boolean algebra and Switching Functions, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II: Combinational Logic

Analysis and Synthesis Procedure, Design of Adder and Substractor, Binary Parallel Adder, Carry look ahead Adder, Magnitude Comparator, Data Selector and Data Distributor, Code Converters, Parity Bit Generators and Checkers.

UNIT III: Sequential Logic

Latches, Pulse and Edge-Triggered Flip-Flops, Applications of Flip-flops, State Machine, State Diagram, Characteristic Equation and Excitation Table, Shift Registers, Universal Shift Register, Design of Counters, Counter Applications

UNIT IV: Logic Families

Logic Families and Characteristics, RTL, DTL, TTL, IIL, MOS, CMOS, BiCMOS Logic, TTL to CMOS interface, CMOS to TTL interface, IEEE/ANSI representation of Logic families

UNIT V: Memories

Role of Memory in a computer, Random Access Memory, Memory Expansion, Introduction to Programmable Logic Devices, Read-Only Memory, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

15 WEEK COURSE PLAN

Weeks	Lecture (2 Hours)	Pedagogy	Practical (2 Hours)
Week 2	Alphanumeric Codes, Boolean algebra and Switching Functions	Learning through teaching (PPT)	Implementation of Logic Gates

Weeks	Lecture (2 Hours)	Pedagogy	Practical (2 Hours)
Week 3	Karnaugh map Minimization and Quine-McCluskey method of minimization.	Flipped classroom	Design of Adder
Week 4	Analysis and Synthesis Procedure, Design of Adder and Substractor, Binary Parallel Adder, Carry look ahead Adder	Learning through teaching (PPT)	Design of Substractor
Week 5	Magnitude Comparator, Data Selector and Data Distributor	Problem Based learning	Design of Binary Parallel Adder
Week 6	Code Converters, Parity Bit Generators and Checkers	Learning through teaching (PPT)	Design of Carry Look Ahead Adder
Week 7	Latches, Pulse and Edge-Triggered Flip-Flops, Applications of Flip-flops, State Machine, State Diagram, Characteristic Equation and Excitation Table	Learning through teaching (PPT)	Design of Magnitude Comparator
Week 8	Shift Registers, Universal Shift Register	Learning through teaching (PPT)	Design of Data Selector
Week 9	Design of Counters, Counter Applications	Problem Based learning	Design of Data Distributor
Week 10	Logic Families and Characteristics, RTL, DTL, TTL, IIL	Learning through teaching (PPT)	Design of Parity Generators
Week 11	MOS, CMOS, BiCMOS Logic	Flipped classroom	Design of Parity Checkers
Week 12	TTL to CMOS interface, CMOS to TTL interface, IEEE/ANSI representation of Logic families	Learning through teaching (PPT)	Design of Code Converter
Week 13	Role of Memory in a computer, Random Access Memory, Memory Expansion	Flipped classroom	Design of Flip-Flop
Week 14	Introduction to Programmable Logic Devices, Read-Only Memory	Learning through teaching (PPT)	Study of Shift Registers
Week 15	Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)	Problem Based learning	Study of Counters

EXPERIMENTS:

1. Introduction to the Laboratory Equipment and their usage.
2. Implementation of Logic Gates
3. Design of Adder
4. Design of Substractor
5. Design of Binary Parallel Adder
6. Design of Carry Look Ahead Adder
7. Design of Magnitude Comparator
8. Design of Data Selector
9. Design of Data Distributor
10. Design of Parity Generators
11. Design of Parity Checkers
12. Design of Code Converter
13. Design of Flip-Flop
14. Study of Shift Registers
15. Study of Counters

TEXT BOOK(S):

1. S. Salivahanan, S. Arivazhagan, "Digital Circuits and Design", Oxford University Press, India, 2018(5th Edition), ISBN: 978019948868
2. Anand Kumar A., "Fundamentals of Digital Circuits", PHI, 2016 (4th Edition), ISBN: 9788120352681

REFERENCES:

1. Donald P Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications. ”, McGraw Hill, 2014(8th Edition, SIE), ISBN: 9789339203405

2. M. Rafiquzzaman, “Fundamentals of Digital Logic and Microcomputer Design”, Wiley, 2005(5th Edition), ISBN: 9788126522590

3. Morris M. Mano, “Digital Logic and Computer Design, Pearson Education”, 2016, ISBN:9789332542525

4. A. Saha, N. Manna, “Digital Principles and Logic Design: Fundamentals and Modern applications”, Jones and Bartlett Publishers, 2010, ISBN: 9780763773731

5. Thomas L. Floyd, “Digital Fundamentals”, Pearson Education, 2011(10th Edition), ISBN:9788131734483

3.4 212CSE2403: JAVA PROGRAMMING

212CSE2403	**JAVA PROGRAMMING**	**L** 1	**T** 0	**P** 6	**X** 0	**C** 4
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Practical						

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and characteristics of Java
- To know the principles of packages, inheritance, exceptions and interfaces.
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces
- To build applications using java programming for real-world applications.

COURSE OUTCOMES:

CO1: Understand the object oriented programming concepts

CO2: Apply the fundamental programming concepts of Java to develop stand alone applications.

CO3: Solve real world problems using reusable and error free code.

CO4: Design and Develop distributed applications

CO5: Implement window based applications using event handling mechanisms.

CO6: Communicate effectively with the technical community.

CO7: Work effectively independently or as a member of a team for a multi-disciplinary environments.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S													
CO2	S				M							M		M
CO3	S				M							M		M
CO4	S				S							M		S
CO5	S				S							S		S
CO6	S	M	M	M	S			M	M	S	M	S	M	S
CO7										S		S		

UNIT I: OOP IN JAVA & INHERITANCE

Object Oriented Programming Concepts - OOP in Java – Characteristics of Java –Fundamental Programming Structures in Java – Defining classes in Java – Comments, Data Types, Variables, Operators, Control Flow, Arrays - constructors, methods -access specifiers - static members – Packages- Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- Strings.

UNIT II: EXCEPTION HANDLING AND I/O

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements-Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files - abstract classes and methods - final methods and classes

UNIT III: INTERFACES AND MULTITHREADING

Interfaces – defining an interface, implementing interface, differences between classes and interfaces - extending interfaces - Object cloning -inner classes-Differences between multithreading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads - Generic Programming.

UNIT IV: AWT AND EVENT DRIVEN PROGRAMMING

AWT Event Hierarchy- Components - Graphics programming – Applets-Frame –working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - Introduction to Swing – layout management - Swing Components – Windows –Menus – Dialog Boxes.

UNIT V: NETWORKING AND JDBC

Networking Basics - The Networking Classes and Interfaces - TCP/IP Client Sockets-URL - TCP/IP Server Sockets - Datagrams - A Relational Database Overview - JDBC Introduction - JDBC Product Components - JDBC Architecture - Case studies.

15 WEEK COURSE PLAN

Week	Lecture (1 hour)	Pedagogy	Practical (6 hours)
Week 1	Object Oriented Programming Concepts - OOP in Java – Characteristics of Java	Explicit Teaching	Familiarise with JVM, Java Programming Structure
	Fundamental Programming Structures in Java – Defining classes in Java – Comments	Demonstration	Hands-on-session for simple class

	Data Types, Variables, Operators, Control Flow	PPT	Hands-on-session for data types, relational operators, for, while and do..while loops
Week 2	Arrays - Strings	Demonstration	Hands-on-session for 1D, 2D arrays, methods in String class
	Constructors, Methods - Access specifiers	PPT	Hands-on-session for default, parameterized constructors, private, public, static data members.
	Static members – Packages	Demonstration	Hands-on-session for Package creation.
Week 3	Inheritance – Super Classes - Sub Classes	PPT	Hands-on session for single, multilevel, hierarchical inheritance
	Protected members	Demonstration	Hands-on-session for protected members and super method to call base class constructor in sub classes
	Constructors in Sub classes	Demonstration	Selection of Mini Project Title
Week 4	Exceptions - Exception hierarchy - Throwing and catching exceptions	PPT	Hands-on-session for built-in Exception classes
	Built-in exceptions, Creating own exceptions, Stack Trace Elements.	Demonstration	Hands-on-session for user defined exception
Week 5	Input / Output Basics – Streams – Byte streams and Character streams	PPT	Hands-on-session for File I/O, Console I/O
	Reading and Writing Console – Reading and Writing Files	Demonstration	Presentation of Mini Project titles
Week 6	Abstract classes	PPT	Hands-on-session for dynamic polymorphism
	Abstract Methods	PPT	Presentation of Modules in Mini Project
Week 7	Interfaces – Defining an interface, Implementing interface	PPT	Hands-on-session for Multiple inheritance
	Differences between Classes and Interfaces - Extending interfaces	PPT	Hands-on-session for interface inheritance
	Inner classes	Demonstration	Hands-on-session for Inner Class

Week 8	Differences between multi-threading and multitasking, Thread life cycle, Creating threads, Synchronizing threads, Inter-thread communication, daemon threads	PPT	Hands-on-session fo single and multiple threads, Inter thread communication
Week 9	Generic Class	Demonstration	Hands-on-session for Generic method an Generic Class implementation
	Generic Method	Demonstration	Presentation of Modules in Mini Project
Week 10	AWT Event Hierarchy - Components - Graphics programming - Frame – Working with 2D shapes	Demonstration	Hands-on-session for Frames window creation, Drawing Lines, circles, ellipse using awt package
	Using Color, fonts, and Images	Demonstration	Hands-on-session for Colors, Fonts and Images
Week 11	Introduction to Swing – layout management - Swing Components – Windows	Demonstration	Hands-on-session forLayout management using Swing Components
Week 12	Basics of event handling - Event handlers - Adapter classes	Demonstration	Hands-on-session for event handling using mouse, action, menu and dialog creation
	Action Event - Mouse events – Menus – Dialog Boxes	Demonstration	Mini Project Demonstration
Week 10	Networking Basics - The Networking Classes and Interfaces	Demonstration	Mini Project Report and PPT Submission
	TCP/IP Client Sockets-URL - TCP/IP Server Sockets - Datagrams	PPT	Hands-on-session for client server programs using TCP/IP, UDP
Week 14	A Relational Database Overview - JDBC Introduction - JDBC Product Components - JDBC Architecture	Demonstration	Hands-on-session for JDBC Connectivity and Mini Project Viva Voce
Week 15	Java Frameworks - Spring Boot	Demonstration	Mini Project Viva Voce

EXPERIMENTS:

1. Basic Java Programs
2. Programs using Objects and Classes
3. Programs using Inheritance
4. Programs using Interfaces
5. Programs using Array List and String
6. Programs using Exception Handling
7. Programs using Reading and Writing Files
8. Programs using Multithreading
9. Programs using Generic Programming
10. Programs using Event Handling, Swing and AWT
11. Programs using TCP/IP and UDP sockets
12. Programs using JDBC

TEXT BOOK(S):

1. Java - The Complete Reference, Herbert Schildt, Tata McGraw-Hill, Eighth Edition, 2011.
2. Core Java: Volume I – Fundamentals Cay S. Horstmann and Gary Cornell, Nineth Edition, Sun Microsystems Press, 2013.

REFERENCES:

1. Java SE 8 for Programmers Paul Deitel, Harvey Deitel / Pearson / 3rd Edion / 2015
2. Understanding Object-oriented programming with Java Timothy Budd / Pearson Education / 2000
3. The Java Programming Language-A primer Ken Arnold, James Gosling, David Holmes, , Fourth Edition, Prentice Hall

3.5 212CSE2303: SOFTWARE ENGINEERING

212CSE2303	**SOFTWARE ENGINEERING**	**L** 2	**T** 0	**P** 2	**X** 0	**C** 3
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

The course provides knowledge in introducing the concepts and terms used in the object-oriented approach to systems analysis and design. This course highlights the importance of object-oriented analysis and design and its limitations. The course shows how to apply the process of object-oriented analysis and design to software development. It points out the importance and function of each UML model throughout the process of object-oriented analysis and design and explains the notation of various elements in these models. It provides students with the necessary knowledge and skills in using object-oriented CASE tools.

COURSE OUTCOMES:

CO1: Create a list of use cases, classes, objects out of the given problem summary.

CO2: Develop the steps in each phase of the software development model.

CO3: Apply the given UML tool on identified models.

CO4: Verify the deliverables of the model with sample inputs.

CO5: Document the refined designs and coding.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S		M										M	
CO2	S	S	S										S	
CO3	S		S										S	
CO4	S				S									S
CO5	S		M			S							M	

UNIT I: Software Engineering Concepts

Software and Software Engineering - Project Management Concepts - Software Engineering Paradigms Generic Process Models, Assessment and Improvement, Use Case Model: Goals, Actors - Finding Primary Actors, Use Case types and Formats.

UNIT II: Elaboration Phase And Interaction Diagram

Definition of the Elaboration phase, identify system events and system operations, Creating a System Sequence Diagram, Interaction diagrams: Importance of interaction diagrams-Sequence diagrams. Creating a collaboration diagram.

UNIT III: Design Concepts

Design Process - Design Principles - Design Concepts - Software Architecture Architectural Style, Design and Mapping - User Interface Design. Class diagram, state diagram.

UNIT IV: Software Testing and Debugging

Testing Fundamentals and Strategies - White-box and Black-box testing - Basis Path Testing - Data Flow Testing - Testing for Special Environments - Unit Testing, - Integration Testing - Validation Testing - System Testing Debugging - Software Maintenance.

UNIT V: Implementation Model

Applying patterns and assigning responsibilities, Coupling and Cohesion, Define frameworks, Mapping designs to code-Creating class definitions from DCDs, Creating methods from interaction diagrams UML and CASE tools.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Introduction to Software Engineering,Project Management Concepts,Software Engineering Paradigms Generic	Explicit Teaching	Identify project scope,Identify the objective,Identify the requirements for problem.
Week 2	Process Models,Assessment and Improvement	Explicit Teaching and Demonstration	Constructing the SRS for the problem,Describing the module description for the problem,Identify the software requirement analysis,
Week 3	Use Case Model,Goals, Actors - Finding Primary Actors, Use Case types and Formats	Explicit Teaching	Identify the actors,Defining the usecases for the application,Identify the relationship between use case and actor.
Week 4	Definition of the Elaboration phase,Identify system events and system operations	Explicit Teaching and Demonstration	Constructing the class diagram ,Identify the relationship between classes

Week 5	Creating a System Sequence Diagram,Interaction diagrams: Importance of interaction diagrams-Sequence diagrams. Creating a collaboration diagram	Explicit Teaching and Demonstration	Hands-on session on interaction diagram
Week 6	Design Process, Design Principles	Explicit Teaching and Demonstration	Creating the State diagram,Identify the relationship between various states
Week 7	Software Architecture, Architectural Style,Design and Mapping	Explicit Teaching and Demonstration	Creating the Activity diagram
Week 8	User Interface Design	Explicit Teaching	Identify the user interface for the application
Week 9	Class diagram, state diagram	Explicit Teaching and Demonstration	Identify the user interface for the application Constructing the various diagram for the application
Week 10	Testing Fundamentals and Strategies,White-box and Black-box testing - Basis Path Testing - Data Flow Testing	Explicit Teaching	Creating the various test cases for the problem
Week 11	Testing for Special Environments - Unit Testing, - Integration Testing - Validation Testing	Explicit Teaching	Integration testing is applied
Week 12	System Testing Debugging - Software Maintenance	Explicit Teaching and Demonstration	Creating class definitions from DCDs
Week 13	Definition of the Elaboration phase,Identify system events and system operations	Explicit Teaching and Demonstration	Constructing the class diagram ,Identify the relationship between classes
Week 14	Coupling and Cohesion, Define frameworks, Mapping designs to code	Explicit Teaching and Demonstration	Creating application using CASE tools
Week 15	Case Study	Demon-stration	Project Evaluation

EXPERIMENTS:

1. Software personnel management system

2. Web-based CPU usage monitor
3. Video Conferencing
4. Pattern Recognition
5. Character Recognizer
6. Intranet Memory Usage Analyzer
7. Foreign trading system
8. Expert Systems
9. Remote Procedure Call Implementation
10. Real-Time Scheduler

TEXT BOOK(S):

1. Larman C. Applying UML and Patterns. An Introduction to Object -Oriented Analysis and Design, Prentice-Hall, 3rd Edition, 2015.

REFERENCES:

1. Bjarne Stroustrup, The C++ Programming Language, 3rd Edition, 2010.
2. Grady Booch, James Runbaugh, Ivar Jacobson, UML User Guide, Addison Wesley, 2010.
3. Tom Pender, UML 2.0 Bible, Wiley Publishing, Inc, 2013.

3.6 212CSE2101: DISCRETE MATHEMATICS

212CSE2101	Discrete Mathematics	L 3	T 1	P 0	X 0	C 4
Pre-requisite : NIL **Course Category :** Program Core **Course Type :** Theory						

COURSE OBJECTIVES:

- To specify and manipulate basic mathematical objects such as sets, functions and relations.
- To develop logical thinking and its application to computer science.
- To analyze the recurrence relation and generating functions
- To use graphs as tools to visualize and simply real life situations.

COURSE OUTCOMES:

CO1: Analyze the operations on sets, relations and functions

CO2: Apply the concepts of tautology, normal forms and theory of inference in studying of the design computers and electric circuits.

CO3: Create the recurrence relations and generating functions.

CO4: Apply the concepts of lattice, modular, distributive lattices and Boolean algebra in engineering mathematical problems.

CO5: Apply the basic concepts in graph theory to computer science engineering and information technology.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M											M	
CO2	S	S											S	
CO3	S			S	M	L							S	M
CO4	S			S	M	L							S	M
CO5	S	S			M								S	

UNIT I: SET THEORY, RELATIONS AND FUNCTIONS

Principle of Inclusion-Exclusion – Types of Relations – Some operations of relations – Composition of relations – Equivalence classes – Functions – one-to-one – onto –Composition of functions– Inverse of a function. (Proofs of theorems are not included)

UNIT II: LOGIC

Propositions – Connectives – Conditional and bi-conditional propositions – Tautology and contradiction – Algebra of propositions – Tautological implication – Normal forms – Disjunctive and conjunctive normal forms – Principal disjunctive and principal conjunctive normal forms.

UNIT III: COMBINATORICS

Permutations and combinations –Recurrence relations – Particular solutions – Solutions of recurrence relations by using generating functions.

UNIT IV: LATTICES AND BOOLEAN ALGEBRA

Lattices– Properties of Lattices – Lattices as algebraic system – Sub lattices – Boolean algebra – Additional properties of Boolean algebra.

UNIT V: GRAPH THEORY

Basic definitions – Degree of a vertex – Some special simple graphs – Matrix representation of graphs – paths, cycles and connectivity –Eulerian and Hamiltonian graphs (Proofs of Theorems are not included) – Connectedness in directed graphs – Trees – Spanning trees – Prim's algorithm –Kruskal's algorithm. (Proofs of Theorems are not included)

15 WEEK COURSE PLAN

Course Chart:	Lecture (3 Hours)	Practical (2Hours)	Pedagogy
Weeks			
Week 1	Principle of Inclusion-Exclusion	Matlab Programs to understand types of relations	Interactive white Board
	Some operations of relations	Matlab Programs to understand types of relations	Demonstration with Matlab
Week 2	Compositions of Relations	Matlab programs to find equivalence classes	Interactive white Board

	Types of Relations,,Equivalence classes	Matlab programs to find equivalence classes	Demonstration with Matlab
Week 3	Functions – one-to-one – onto	Matlab for functions, inverse of functions	Interactive white Board
	Composition of functions– Inverse of a function.	Matlab for functions, inverse of functions	Demonstration with Matlab
Week 4	Propositions – Connectives	Matlab for Tautology and Contradiction	Interactive white Board
	Tautology and contradiction	Matlab for Tautology and Contradiction	Demonstration with Matlab
Week 5	Algebra of propositions	Matlab for Algebra of Propositions	Interactive white Board
	Conditional and bi-conditional propositions	Matlab for Algebra of Propositions	Demonstration with Matlab
Week 6	Tautological implications ,Normal Forms	Matlab for Disjunctive and conjuctive normal forms	Interactive white Board
	Disjunctive and conjunctive normal forms	Matlab for Disjunctive and conjuctive normal forms	Demonstration with Matlab
Week 7	Principal disjunctive normal forms	Matlab for PCNF and PDNF	Interactive white Board
	Principal conjunctive normal forms	Matlab for PCNF and PDNF	Demonstration with Matlab
Week 8	Permutations	Matlab for Permutations and combinations	Interactive white Board
	Combinations	Matlab for Permutations and combinations	Demonstration with Matlab
Week 9	Recurrence relations, Particular solutions	Matlab for generating functions	Interactive white Board
	Solutions of recurrence relations using generating functions	Matlab for generating functions	Demonstration with Matlab

Week 10	Lattices	Matlab for Lattices	Interactive white Board
	Properties of Lattices	Matlab for Lattices	Demonstration with Matlab
Week 11	Lattices as algebraic system	Matlab for Lattices as algebraic system	Interactive white Board
	Sub lattices	Matlab for Lattices as algebraic system	Demonstration with Matlab
Week 12	Boolean algebra	Matlab for Boolean Algebra	Interactive white Board
	Additional properties of Boolean algebra.	Matlab for Boolean Algebra	Demonstration with Matlab
Week 13	Basic definitions – Degree of a vertex – Some special simple graphs	Matlab for degree of a vertex	Interactive white Board
	Matrix representation of graphs	Matlab for degree of a vertex	Demonstration with Matlab
Week 14	paths, cycles and connectivity – Eulerian and Hamiltonian graphs	Matlab for verifying Eulerian and Hamiltonian graphs	Interactive white Board
	Connectedness in directed graphs	Matlab for verifying Eulerian and Hamiltonian graphs	Demonstration with Matlab
Week 15	Trees – Spanning trees	Matlab for Prim's algorithm and Krushkals algorithm	Interactive white Board
	Prim's algorithm – Kruskal's algorithm.	Matlab for Prim's algorithm and Krushkals algorithm	Demonstration with Matlab

TEXT BOOK(S):

1. T. Veerarajan, Discrete Mathematics with graph theory and Combinatorics, Tata McGraw Hill Publishing Company Limited, 26th reprint 2017.

REFERENCES:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill Publishing Company, 1999.

2. M.K. Venkataraman, N. Sridharan, N. Chandrasekaran, Discrete Mathematics, National Publishing Company, 2009.

3.7 212CSE2304: MACHINE LEARNING

212CSE2304	Machine Learning	L 2	T 0	P 2	X 3	C 4
Pre-requisite : NIL **Course Category :** Program Core **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- To introduce Machine Learning and its benefits
- To understand simple linear regression and its significance.
- To gain knowledge on multiple regression and interpret multiple linear regression coefficients
- To introduce classification and various classification algorithms.
- To provide knowledge on clustering algorithms and various information retrieval models.

COURSE OUTCOMES:

CO1: Understand the origin, uses, concept, types and applications of Machine Learning.

CO2: Understand the mathematics behind learning algorithms and apply simple linear regression on datasets with performance evaluation.

CO3: Design and Evaluate Multiple Regression models on real time datasets.

CO4: Understand and Apply various classification algorithms in Machine Learning and visualize the results.

CO5: Apply various clustering algorithms on real time datasets and analyze the efficiency of each algorithm in different usecase scenarios.

CO6: Create real time datasets from social/ public websites using information retrieval techniques

CO7: Create efficient machine learning models to perform analysis and prediction on real datasets

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			S	M								S	M
CO2	S			S	M								S	M
CO3	S		S	S									S	
CO4	S													
CO5	S													
CO6	S			S	M								S	M
CO7	S	S			M								S	M

UNIT I: Introduction to Machine Learning

Introduction, Motivation for machine learning, Applications, Machine learning, Classification, Regression, The origin of machine learning, Timeline of machine learning techniques, Uses and abuses of machine learning, How do machines learn, Abstraction and knowledge representation, Generalization, Assessing the success of learning, Steps to apply machine learning to data, Input data and ML algorithm, Machine learning methods, Unsupervised learning, Semi-supervised learning, Clustering, What are we looking for? Classification of machine learning algorithms, General ML architecture, Reinforcement learning, Supervised learning, Unsupervised learning, Semi-supervised learning, Regularization algorithms, Clustering algorithms, Deep learning algorithms, Ensemble learning, Matching data to an appropriate algorithm, Data Retrieval, Web Scrapping, BeautifulSoup, Sklearn, Seaborn packages in Python.

UNIT II: Simple Linear Regression

Introduction, Supervised learning, Regression, Regression examples, Regression models, Steps in regression analysis, Linear regression, Simple linear regression, Least squares estimation, Least squares regression-Line of best fit, Illustration, Direct regression method, Maximum likelihood estimation, Matrix approach, Regression assumptions and model properties, Coefficient of determination (R-squared), Example, Testing for significance, Testing hypothesis in simple linear regression, Illustration, Checking model adequacy, Over-fitting, Detecting over-fit models: Cross validation, Cross validation: The ideal procedure, Logistic regression.

UNIT III: Multiple Regression and Model Building

Introduction, Ordinary least squares estimation for multiple linear regression, Multiple linear regression model building, Partial correlation and regression model building, Multiple linear regression model, Interpretation of multiple linear regression coefficients-Partial regression coefficients, Standardized regression coefficients, Missing data, Validation of multiple regression model, Coefficient of multiple determination (R-Squared), Adjusted R-squared, Statistical significance of individual variables in multiple linear regression: Hypothesis Testing, Student's T-Test, Chi-squared test, Comparison of hypothesis tests.

UNIT IV: Introduction to Classification & Classification Algorithms

Preamble: Machine learning, To classify faces and expressions, Introduction, ML classifier, Classification and general approach, Classification algorithms, Instance based learning, K-Nearest neighbour, Decision trees, Attribute selection measure: Information gain, ID3 algorithm, Decision tree: weekend example, Converting a tree to rules, Bayesian algorithms,Naïve Bayes Classifier, Example, Ensemble, Stories of success, Why ensemble works? Ensemble of classifiers, Bagging, Boosting, Random forests, Neural networks, Activation functions, Feedforward neural network, Multi-layer perceptron, Backprop algorithm, Recurrent or feedback architecture, Perceptron rule, Gradient-descent (training examples, ç), Multilayer networks and back propagation algorithm, Support vector machine,SVM with linear kernel, polynomial kernel, RBF kernel, sigmoid kernelClassification model evaluation and selection, ROC curves, Cost Benefit Analysis (CBA).

UNIT V: Clustering Techniques and Information Retrieval

Clustering, Clustering algorithms, More common clustering situation, Statistics associated with cluster analysis, General applications of clustering, Clustering as a preprocessing tool, Hard vs. soft clustering, Similarity and dissimilarity between objects, Type of data in clustering analysis, Binary variables, Nominal variables, Ordinal variables, Major clustering approaches, Types of clusters, Cluster centroid and distances, Hierarchical clustering, Hierarchical Agglomerative Clustering (HAC), Hierarchical Agglomerative Clustering: Linkage method, Hierarchical Agglomerative Clustering: Variance and Centroid method, Cluster distance measures, Single link agglomerative clustering, Complete-link clustering, Average-link clustering, Other agglomerative clustering methods, Distance between two clusters, Hierarchical clustering: Time and Space requirements, K - means clustering, Importance of choosing initial centroids, The K-medoids clustering method, PAM (Partitioning Around Medoids), CLARA (Clustering Large Applications), CLARANS (Randomized CLARA), Density based clustering methods, DBSCAN: Density Based Spatial Clustering of Applications with Noise, When DBSCAN Does NOT Work Well, External criteria for clustering quality, Different aspects of cluster validation, Measures of cluster validity, Measuring cluster validity via correlation, Using similarity matrix for cluster validation, Internal measures: SSE, Framework for cluster validity, Internal measures: Cohesion and Separation, Internal measures: Silhouette coefficient. Information retrieval- introduction, Information retrieval process, Information retrieval architecture, how do we represent document? Information retrieval models, Similarity metric, Term weighting, Retrieval in vector space model, Constructing inverted index (word counting), Stop words removal, Stemming, Text document clustering, Agglomerative vs. divisive, Impact of cluster distance measure, Buckshot clustering, Issues related to cosine similarity, Validity of document clusters, Text datasets, Experimental evaluation.

15 WEEK COURSE PLAN

Course Chart	Lecture (2 hours)		Practical (2 hours)	X Component (3 hours) ”Learn Machine Learning using Sports”	
Weeks	Topic	Pedagogy		Topic	Pedagogy

Week 1	Introduction, Motivation for machine learning, Applications, Machine learning, Classification, Regression, The origin of machine learning	Explicit Teaching	Hands-on session on Pandas, Numpy Packages	Webscraping	Demonstration
	Time line of machine learning techniques, Uses and abuses of machine learning, How do machines learn, Abstraction and knowledge representation, Generalization	Experiential Learning	sklearn Package	Hackathon Project - Problem Description, Team Formation and Initiation	Cooperative Learning
	Assessing the success of learning, Steps to apply machine learning to data, Input data and ML algorithm, Machine learning methods, Unsupervised learning, Semi-supervised learning, Clustering	Explicit Teaching			
Week 2	Least squares estimation, Least squares regression Line of best fit, Illustration	Explicit Teaching & Demonstration	Linear Regression	Comparison of Linear, Polynomial, Lasso and Ridge Regression on ESPNCricinfo ODI Batsmen Dataset using Variance, Determination, Accuracy, Confusion Matrices	Independent Study
			Polynomial Regression		

Week 3	Direct regression method, Maximum likelihood estimation, Matrix approach, Regression assumptions and model properties, Coefficient of determination (R-squared), Example	Problem Solving	Checking model adequacy, Over-fitting, Detecting over-fit models: Cross validation, Cross validation: The ideal procedure	Logistic Regression on ESPN-Cricinfo ODI Bowlers Dataset	Independent Study
	Testing for significance, Testing hypothesis in simple linear regression, Illustration	Problem Solving			
Week 4	Introduction, Ordinary least squares estimation for multiple linear regression, Multiple linear regression model building	Explicit Teaching	Interpretation of multiple linear regression coefficients-Partial regression coefficients, Standardized regression coefficients	Missing data, Validation of multiple regression model	Independent Study
	Partial correlation & regression model building, Multiple linear regression model	Explicit Teaching		Hackathon Project - Review 1	Project-Based Learning
Week 5			Estimate Variance, Coefficient of Determination and F Score for real time dataset	Hypothesis Testing: Student's T Test, Chi-square test	Independent Study
	Coefficient of multiple determination (R-Squared), Adjusted R-squared	Demonstration			
Week 6	Statistical significance of individual variables in multiple linear regression: t-Test	Explicit Teaching		Industry Expert Interaction for Hackathon Project	Independent Study
Week 7	Introduction, ML classifier, Classification and general approach, Classification Algorithms	Explicit Teaching	K-Nearest neighbour	Understanding the data for Classification – ODI Players with closest characteristics	Independent Study
	Instance Based Learning	Explicit Teaching			

Week 8	Decision trees, Attribute selection measure: Information gain, ID3 algorithm	Explicit Teaching & Problem Solving	Decision tree: weekend example, Converting a tree to rules	Decision Tree Learning – What decides the outcome of the cricket match	Independent Study
	Bayesian algorithms	Explicit Teaching	Naïve Bayes Classifier	Naïve Bayes Classifier – How Bayes define the Decider	Independent Study
Week 9	Ensemble, Stories of success, Why ensemble works? Ensemble of classifiers, Bagging, Boosting	Explicit Teaching	Random Forest	Ensemble Classifier– What decides the outcome of the cricket match	Independent Study
Week 10	Neural networks, Activation functions, Feedforward neural network	Explicit Teaching	Recurrent or feedback architecture	Neural Network Parameter Estimation on a structured network	Problem Based Learning
	Multi-layer perceptron, Backprop algorithm	Explicit Teaching			
Week 11	Perceptron rule, Gradient-descent (training examples), Multilayer networks and back propagation algorithm	Explicit Teaching	Classification model evaluation and selection, ROC curves, Cost Benefit Analysis (CBA)	Support Vector Machines – Predict Win, Loss, Draw	Independent Study
	Support Vector Machine	Explicit Teaching			
Week 12	Clustering, Clustering algorithms, More common clustering situation, Statistics associated with cluster analysis, General applications of clustering	Explicit Teaching	Hierarchical Agglomerative Clustering: Linkage method, Hierarchical Agglomerative Clustering: Variance and Centroid method	Hackathon Project Review 2 and Research Article Preparation	Project Based Learning
	K Means, Hierarchical clustering, Hierarchical Agglomerative Clustering (HAC)	Explicit Teaching & Problem Solving		k Means Clustering – Cluster similar kind of players_part 01	Independent Study

Week 13	Importance of choosing initial centroids in K Means, The K-medoids clustering method	Experiential Learning	Problem Identification and Backend details	k Medoid Clustering – Cluster similar kind of players_part 02	Independent Study
	PAM (Partitioning Around Medoids)	Explicit Teaching			
Week 14	CLARA (Clustering Large Applications), CLARANS (Randomized CLARA)	Explicit Teaching	DBSCAN: Density Based Spatial Clustering of Applications with Noise	DBSCAN Clustering – Cluster similar kind of players_part 03	Independent Study
	Density based clustering methods, When DBSCAN Does NOT Work Well	Experiential Learning			
Week 15	External criteria for clustering quality, Different aspects of cluster validation, Measures of cluster validity, Measuring cluster validity via correlation, Using similarity matrix for cluster validation	Explicit Teaching	Principal Component Analysis – Act on Handwritten Characters	Hackathon Project - Final Review	Project Based Learning
	Internal measures: SSE, Framework for cluster validity, Internal measures: Cohesion and Separation, Internal measures: Silhouette coefficient.	Explicit Teaching		Paper Submission to IEEE Conferences	Project Based Learning

EXPERIMENTS:

1. Data Scraping – Frontend to Backend – BeautifulSoup
2. Multiple linear Regression – Model the strike rate of a batsman in ODI
3. k Nearest Neighbor – ODI Bowler with closest characteristics

4. Decision Tree Learning – What decides the outcome of the cricket match
5. Naïve Bayes Classifier – How Bayes define the Decider
6. k Means Clustering – Cluster similar kind of players_part 01
7. k Medoid Clustering – Cluster similar kind of players_part 02
8. DBSCAN Clustering – Cluster similar kind of players_part 03
9. Support Vector Machines – Predict Win, Loss, Draw
10. Principal Component Analysis – Act on Handwritten Characters
11. Case Study Project

TEXT BOOK(S):

1. Machine Learning, 2019 (IBM ICE)
2. Tom Mitchell, Machine Learning, McGrawHill, 1997

REFERENCES BOOKS:

1. Andrew Ng, Machine Learning, deeplearning.ai, 2018

3.8 212CSE2305: DATABASE MANAGEMENT SYSTEMS

212CSE2305	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**X**	**C**
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To make students to understand the different issues involved in the design and implementation of a database system.
- To make students to understand the different issues involved in the design and implementation of a database system.

COURSE OUTCOMES:

CO1: Describe the fundamental elements of relational database management systems

CO2: Explain the basic concepts of relational data model, entity-relationship model, relational database design, and SQL.

CO3: Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO4: Execute various advance SQL queries related to Transaction Processing Locking using concept of Concurrency control.

CO5: Understand latest trends in Database Management techniques.

CO6: Perform PL/SQL programming using concept of Cursor Management, Error Handling, Package and Triggers.

CO7: Apply acquired knowledge for developing holistic solutions based on database systems/database techniques .

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MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			S									S	
CO2	S				S									S
CO3	S					S								
CO4	S	S			S	S							S	S
CO5	S	S			S	S							S	S
CO6	S	S		S		S	S						S	
CO7	S	S		S		S							S	

UNIT I: INTRODUCTION

Introduction to File Systems – File systems vs Database systems- -Abstraction levels of DBMS- Data Models-Introduction to Network andHierarchical Models -ER Model - E-R Diagrams – Relational Model- Relational Algebra- Relational Calculus- Database System Structure -Database Languages.

UNIT II: RELATIONAL MODEL

SQL Data Definition – Queries in SQL- Updates-Views-Keys- Integrity and Security- Sub Queries - Correlated Sub Queries - Relational Database Design -Functional Dependences and Normalization For Relational Databases (up to BCNF).

Record Storage and Primary File Organization - Secondary Storage Devices- Operations on Files - Heap File - Sorted Files - Hashing Techniques Index Structure for Files Different Types of Indexes B-Tree - B+Tree Database Tuning - Query Processing.

UNIT IV: TRANSACTION MANAGEMENT

Transaction in DBMS- ACID Properties- Need for Concurrency Control - Schedule – Serializability- Concurrency Control- Types of Locks- Two Phases locking- Deadlock- Time Stamp based Concurrency Control Recovery Techniques Concepts - Immediate Update - Deferred Update - Shadow Paging.

UNIT V: CURRENT TRENDS

Object Oriented Databases- OO Data models- Distributed Databases- Homogenous and Heterogeneous – Distributed data storage – Multimedia Databases- XML Structure-XML Document Schema- Data mining- Data Warehouse- Database Security- Database Application Security Models.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)

Week 1	Introduction to File Systems	Power point presentation	Introduction to SQL, Database Languages
	File systems vs Database systems	Power point presentation	Introduction to SQL, Database Languages
	Abstraction levels of DBMS	Power point presentation	Introduction to SQL, Database Languages
Week 2	Data Models	Flipped videos	Commands related to Data Definition Language
	Network and Hierarchical Models	Flipped videos	Commands related to Data Definition Language
	Network and Hierarchical ER Model and E-R Diagrams	Flipped videos	Commands related to Data Definition Language
Week 3	Relational Model	Power point presentation	Commands related to Data Manipulation Languages
	Relational Algebra and Relational Calculus	Power point presentation	Commands related to Data Manipulation Languages
	Database System Structure	Power point presentation	Commands related to Data Manipulation Languages
Week 4	Database Languages	Power point presentation, Flipped videos, Demo: Implement DDL,DCL, TCL commands	Commands Related to Transaction Control Languages
	SQL Data Definition , Queries in SQL	Power point presentation, Flipped videos, Demo: Implement DDL,DCL, TCL commands	Commands Related to Transaction Control Languages
Week 5	Updates-Views-Keys, Integrity and Security	Collaborative Teaching – Seminar Self-Study Topic	Built-in Functions and Aggregate Functions in RDBMS
	Sub Queries - Correlated Sub Queries	Collaborative Teaching – Seminar Self-Study Topic	Built-in Functions and Aggregate Functions in RDBMS

Week 6	Relational Database Design	Power point presentation	Implementation of Simple Programs using PL SQL
	Functional Dependences and Normalization For Relational Databases , Boycee Codd Normal form.	Power point presentation	Implementation of Simple Programs using PL SQL
Week 7	Record Storage and Primary File Organization , Secondary Storage Devices	Structured Overview	Cursor Implementations-Example Programs
	RAID Models	Structured Overview	Cursor Implementations-Example Programs
Week 8	Operations on Files - Heap File - Sorted Files	PPT lecture delivery	Trigger Implementation-Example Programs
	Hashing Techniques	Power point presentationPPT lecture delivery	Trigger Implementation-Example Programs
Week 9	Index Structure for Files Different Types of Indexes B-Tree	Explicit Teaching	RDBMS Procedures Implementation
	B-Tree and B+ Tree, Operations on B+ Tree.	Explicit Teaching	RDBMS Procedures Implementation
	Database Tuning - Query Processing	Explicit Teaching	RDBMS Procedures Implementation
Week 10	Transaction in DBMS-ACID Properties	Explicit Teaching	RDBMS Functions Implementation
	Need for Concurrency Control - Schedule	Explicit Teaching	RDBMS Functions Implementation
Week 11	Serializability- Concurrency Control-	Demonstrations	RDBMS Procedures Implementation
	Types of Locks- Two Phases locking	Demonstrations	Database Design with Normalization
	Deadlock Handling	Demonstrations	Database Design with Normalization
Week 12	Time Stamp based Concurrency Control and Recovery Techniques Concepts	Mastery lecture	Introduction to Database Connectivity-ODBC and JDBC
	Immediate Update - Deferred Update -	Mastery lecture	Introduction to Database Connectivity-ODBC and JDBC
	Role of Shadow Paging	Mastery lecture	Introduction to Database Connectivity-ODBC and JDBC

Week 13	Types of DBMS- Object Oriented Databases- OO Data models and Multimedia Databases	Case studies	Embedded SQL -Mini Project Topic selection and Front End Identification and Group identification
	Distributed Databases- Homogenous and Heterogeneous – Distributed data storage	Case studies	Embedded SQL -Mini Project Topic selection and Front End Identification and Group identification
Week 14	XML Structure-XML Document Schema	Concept formation	Implementation of Mini Project using appropriate backend
	Data Mining and Data Warehouse	Concept formation	Implementation of Mini Project using appropriate backend
Week 15	Security in Database Management Systems	Explicit Teaching	Demonstration and Report submissionof Mini Project
	Database Application Security Models.	Explicit Teaching	Demonstration and Report submissionof Mini Project

EXPERIMENTS:

1. Implementation of DDL commands in RDBMS. .
2. Implementation of DML and DCL commands in RDBMS.
3. Implementation of Date and Built in Functions of SQL.
4. Implementation of Simple Programs.
5. Implementation of High-level language extension with Cursors.
6. Implementation of High level language extension with Triggers
7. Implementation of stored Procedures and Functions.
8. EmbeddedSQL
9. Database design using E-R model and Normalization.
10. Database Connectivity using ADO
11. Database Connectivity using ODBC
12. Database Connectivity using JDBC

TEXT BOOK(S):

1. Abraham Silberschatz, Henry F., Korth and Sudarshan S, Database System Concepts, McGraw-Hill, Seventh Edition, 2019.

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems, Pearson Education, Fifth Edition 2008.

2. Raghu Ramakrishnan, Database Management System, Tata McGraw-Hill Publishing Company, 2003.

3. Hector GarciaMolina, Jeffrey D.Ullman and Jennifer Widom, Database System Implementation, Pearson Education, Second Edition, 2009.

4. C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.

5. Atul Kahate, Introduction to Database Management Systems, Pearson Education, New Delhi, 2006.

6. Alexis Leon and Mathews Leon, Database Management Systems, Vikas Publishing House Private Limited, New Delhi, 2003.

3.9 212CSE2102: COMPUTER ARCHITECTURE AND ORGANIZATION

212CSE2102	**Computer Architecture and Organization**	**L**	**T**	**P**	**X**	**C**
		4	0	0	0	3

Pre-requisite :NIL
Course Category : Program Core
Course Type : Theory

COURSE OBJECTIVES:

- To understand the structure, function and characteristics of computer systems.
- To describe on the fundamental design of various functional units and computer components.
- To analyze the elements of modern instructions sets and their impact on processor design, different elements of memory hierarchy and the different methods of computer I/O.

COURSE OUTCOMES:

CO1: Examine functional units of computer, bus structure and addressing mode.

CO2: Apply the knowledge of algorithms to solve arithmetic unit problems.

CO3: Demonstrate single bus, multiple bus organization and pipelining concepts.

CO4: Analyse the different forms of memory and its organization.

CO5: Evaluate the various I/O interfaces.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S													
CO2	S			S									S	
CO3	S			S	M								S	M
CO4	S	S		S	M								S	M
CO5	S			S	M								S	M

UNIT I: BASIC STRUCTURE OF COMPUTERS

Generation of Computers - Progress achieved in the past years, Changes in Technology - Software Functional Units - Von Neumann model - Software Performance - Instruction Types - Examples - Instruction and Instruction Sequencing - Instruction Format - Memory Locations and Addresses - Machine addressability - Memory Operations - Load Store - Addressing Modes.

UNIT II: ARITHMETIC UNIT

Number Systems – Basic Number Representation – Integer Representation – Signed Addition and Subtraction – 2' s complement Addition - Design of Fast - Multiplication of Positive Numbers – Signed Multiplication – Bit pair Recoding of Multiplier – Restoring and Non-Restoring Division – Basic Floating Point Representation.

UNIT III: BASIC PROCESSING UNIT

Processor Organization– Register Organization - Instruction Cycle – Execution of complete instruction – Instruction Hardwired Control – Micro Programmed Control –Basic Concepts of Pipelining – Different types of Pipeline Hazards – Instruction Level Parallelism and Superscalar Operation.

UNIT IV: MEMORY SYSTEM

Computer System Memory overview – Cache memory principles – Elements of cache Design – Design and performance considerations of cache memory - Semiconductor Main Memory – ROM – External Memory–Virtual Memory Concept.

UNIT V: I/O ORGANIZATION

Need of I/O Module –Basic I/O Operations - Accessing I/O devices – Interrupts - Direct Memory Access – Buses, Bus arbitration, Types of buses - Standard I/O Interfaces (PCI, SCSI, USB).

15 WEEK COURSE PLAN

Week	Lecture (4 hours)	Pedagogy
Week 1	Generation of Computers, Progress achieved in the past years, Changes in Technology, Software Functional Units	Explicit Teaching
	Von Neumann model	Explicit Teaching
	Basic Operational Concepts, Connections between the processor and the memory	Explicit Teaching

	Software Performance, Processor Clock, Basic Performance equation and measurement	Explicit Teaching
Week 2	Instruction Types (zero, one, two and three Address)	Explicit Teaching/ Demonstration
	Examples of 1, 2, 3 and 0-Address Instruction	Explicit Teaching
	Instruction and Instruction Sequencing, Data transfers, ALU, Sequencing and I/O	Explicit Teaching
	Branching and condition codes	Explicit Teaching
Week 3	Memory Locations and Addresses, Machine Addressability, Big endian and little endian	Explicit Teaching
	Memory Operations Load, Store	Explicit Teaching
	Addressing Modes	Explicit Teaching
	Example	Problem Solving
Week 4	Number Systems, Basic Number Representation	Explicit Teaching/ Demonstration
	Numerical Example	Explicit Teaching, Problem Solving
	Integer Representation	Explicit Teaching
	Signed Addition and Subtraction	Explicit Teaching, Problem Solving
Week 5	Design of Fast Adders	Explicit Teaching/ Demonstration
	Carry Save Addition of Summands	Explicit Teaching, Problem Solving
	Multiplication of Positive Numbers	Explicit Teaching, Problem Solving
	Booth Multiplication of Signed Numbers	Explicit Teaching, Problem Solving
Week 6	Bit pair Recoding of Multiplier	Explicit Teaching/ Demonstration
	Restoring Division	Explicit Teaching, Problem Solving
	Non-Restoring Division	Explicit Teaching, Problem Solving
	Basic Floating Point Representation	Explicit Teaching, Problem Solving
Week 7	Processor Organization, Fundamental Concepts	Explicit Teaching/ Demonstration

	Execution of a Complete Instruction, Hardware Components of processor	Explicit Teaching
	Single Bus Organization, Register Transfers, Performing an ALU operation	Explicit Teaching
	Multi-bus Organization, Control signals	Explicit Teaching
Week 8	Instruction Hardwired Control, control step counter	Explicit Teaching/ Demonstration
	Micro-programmed Control, control memory, organization	Explicit Teaching
	Basic Concepts of Pipelining, advantages, stages	Explicit Teaching
	Instruction Level Parallelism, stages	Explicit Teaching
Week 9	Types of pipeline hazards-Data, Control and structural	Explicit Teaching/ Demonstration
	Implementation of pipelining	Explicit Teaching
	Branch prediction, static and dynamic	Explicit Teaching
	Superscalar Operation - out of order B27execution, imprecise exception	Explicit Teaching
Week 10	Memory - Basic concepts	Explicit Teaching/ Demonstration
	Semiconductor RAMs - types, internal organizations, synchronous and Asynchronous RAMs, Dynamic memories	Explicit Teaching
	Internal organization	Explicit Teaching
	Mapping - Direct, Associative and set Associative	Explicit Teaching
Week 11	Cache memory - design considerations	Explicit Teaching/ Demonstration
	Performance consideration - hit rate, miss rate, miss penalty	Explicit Teaching
	memory interleaving and its types	Explicit Teaching
	Improving Hit Rate - prefetching, lock-up free cache	Explicit Teaching

Week 12	Reducing Miss Penalty - write through, write back, principle of locality	Explicit Teaching/ Demonstration
	Virtual Memory - pading, address translation, TLB, Page fault	Explicit Teaching
	Secondary Storage - fixed, removable	Explicit Teaching
	Types of secondary storage	Explicit Teaching
Week 13	Need of I/O Module, Basic I/O Operations	Explicit Teaching/ Demonstration
	Accessing I/O devices - memory mapped, programmed I/O	Explicit Teaching
	Interrupts- vectored interrupts, interrupt nesting	Explicit Teaching
	Handling Interrupt -ISR, Daisy chaining, polling, nested	Explicit Teaching
Week 14	Direct Memory Access - organization, implementation, DMA controller	Explicit Teaching/ Demonstration
	Buses - Introduction	Explicit Teaching
	Synchronous and Asynchronous Bus	Explicit Teaching
	Bus arbitration - centralized , distributed	Explicit Teaching
Week 15	Basics on Standard I/O - protocols and standards	Explicit Teaching/ Demonstration
	serial / Parallel port	Explicit Teaching
	SCSI representation	Explicit Teaching
	Universal Serial Bus	Explicit Teaching

TEXT BOOK(S):

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill, 6'th Edition 2016.

REFERENCES:

1. William Stallings, Computer Organization and Architecture – Designing for Performance, PHI pvt Ltd, 10'th Edition, 2016.

2. David A.Patterson and John L.Hennessy, Computer Organization and Design: The hardware software interface, Morgan Kaufmann, 4'th Edition, 2010.

3. John P.Hayes, Computer Architecture and Organization, McGraw Hill, 3'rd Edition, 2017.

3.10 212CSE3301: DESIGN AND ANALYSIS OF ALGORITHM

212CSE3301	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	X	C
		2	0	2	3	4
Pre-requisite : Data Structure **Course Category :**Program Core **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- Analyze the asymptotic performance of algorithms.
- Apply and write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES:

CO1: Understand the characteristics and types of algorithms and use asymptotic notations to analyze the performance of algorithms

CO2: Analyze the differences in design techniques and apply Greedy and Dynamic Programming strategies to solve Optimization problems

CO3: Apply and Analyze Backtracking and Branch , Bound strategies to solve combinatorial optimization problems respectively

CO4: Understand Tractable and Intractable problems and apply reduction techniques to find problem classes

CO5: Analyze the efficiency of Randomization and Approximation algorithms in solving complex problems

CO6: Create efficient algorithms for real time problem statements by applying appropriate design strategies.

CO7 : Implement the problem statements in programming languages efficiently

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S											S	
CO2	S	S											S	
CO3	S	S											S	
CO4	S	S											S	
CO5	S	S	M		S								S	S
CO6	S	S	M	S	M								S	M
CO7	S	S	M	S	M								S	M

UNIT I: INTRODUCTION TO ALGORITHMS AND ANALYSIS

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds best, average and worst-case behaviour,Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters theorem

UNIT II: FUNDAMENTAL ALGORITHMIC STRATEGIES

Divide and Conquer – Karatsuba algorithm- Strassan matrix multiplication - Brute-Force – String matching - Greedy Techniques Elements of greedy strategy - Single source shortest path - Huffman tree Task Scheduling problem Dynamic programming Principal of optimality - Longest common subsequence - Optimal binary tree

UNIT III:BACKTRACKING AND BRANCH AND BOUND

Backtracking n-Queens Problem Hamiltonian Circuit problem Subset-Sum problem - Branch and Bound Assignment Problem Knapsack Problem - Travelling Salesman Problem-Illustrations of these techniques for Problem-Solving

UNIT IV: TRACTABLE

Tractable and Intractable Problems- Computability of Algorithms- Computability classes-P, NP, NP-complete and NP-hard- Cooks theorem- Standard NP-complete problems and Reduction techniques

UNIT V: ADVANCED TOPICS

Heuristics – Characteristics- Bin packing algorithm -Approximation algorithms – Vertex-Cover - Travelling Salesman Problems - Randomized algorithms, Hiring problem- primarily testing, comparison of strings, Las Vedas - Monte carlo- Randomized Quick Sort Algorithm – Communication algorithm – Case studies

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)	X Component (3 hours)
Week 1	Introduction: Characteristics of algorithm. Analysis of algorithm,Asymptotic Analysis of Complexity bounds best, Average and Worst case behaviour	Explicit Teaching	Logics and Programming	Brute force Problem solving
Week 2	Performance Measurements of Algorithm, Time and space trade-offs,Analysis of recursive algorithms, substitution methods,Recursion tree method	Explicit Teaching	Non - Recursive and Recursive algorithms	Analysis of Problems in terms of time and Space (GATE) and Hackerank Challenge - Level I
Week 3	Masters theorem ,Brute Force - String Matching,Divide and Conquer – Karatsuba algorithm-Strassan matrix multiplication	Explicit Teaching	Problem Scenarios in divide and conquer strategy	Chinese remainder theroem and Closest Pair algorithm
Week 4	Greedy Techniques Elements of greedy strategy - Single source shortest path,Huffman tree Task Scheduling problem	Explicit Teaching	Problem scenarios in Greedy approach	Competitive Programming Challenge - Round I

Week 5	Dynamic programming Principal of optimality, Longest common sub sequence	Explicit Teaching	Problem Scenario in dynamic prograaming	Competitive Programming Challenge - Round I
Week 6	Optimal binary search tree,Backtracking n-Queens Problem Hamiltonian Circuit problem	Explicit Teaching	Problem Scenario in Backtracking techniques	Problem solving using permutation and combination
Week 7	Subset-Sum problem ,Branch and Bound Assignment Problem Knapsack Problem	Explicit Teaching	Problem scenario using Branch and Bound	Problem solving in Project Euler - Level I
Week 8	Travelling Salesman Problem-Illustrations of these techniques for Problem-Solving	Explicit Teaching	Problem scenario using Branch and Bound	Hungarian method for branch and bound
Week 9	Tractable and Intractable Problems-Computability classes- P, NP, NP-complete and NP-hard	Explicit Teaching	Implementation of NP Complete problems	Problem solving in Project Euler - Level II
Week 10	Cooks theorem-Standard NP-complete problems and Reduction techniques.	Explicit Teaching	Implementation of NP - I problems	Competitive Programming Challenge - Round II
Week 11	Randomized algorithm - Las Vegas - Randomized quick sort	Explicit Teaching	Randomized Quick sort	Competitive Programming Challenge - Round II
Week 12	Monte carlo - String communication protocol	Explicit Teaching	String communication protocol	Determininstic Selection

Week 13	Approximation algorithms - Heuristics - Bin packing problem	Explicit Teaching	Bin packing problem	Graphs and Minimum Cuts
Week 14	Vertex-Cover -Analysis	Explicit Teaching	Vertex-Cover	Graphs and Minimum Cuts
Week 15	Travelling Salesman Problems-Hiring problem-primality testing	Explicit Teaching	Problem solving leveraging hiring and primality test	Competitive Programming Challenge - Round III

EXPERIMENTS:

1. Implementation of Euclid's Algorithm
2. Implementation of Consecutive Integer Checking Algorithm
3. Implementation of Middle School Procedure
4. Unique elements in an Array
5. Tower of Hanoi Problem
6. Number of digits in binary using recursion
7. Karatsuba algorithm, strassan Matrix multiplication
8. String Compression Algorithm
9. Task Scheduling Algorithm
10. Longest Common Sub sequence
11. Optimal Binary Tree
12. Binary String Pattern Recognition
13. Segment Summation
14. Hamiltonian Circuit Problem
15. Subset-Sum Problem
16. Knapsack Problem
17. Travelling Salesman Problem
18. Vertex Cover Problem
19. Randomized Quick Sort

20. Graph Colouring Problem
21. Vertex Colouring

TEXT BOOK(S):

1. T.H. Cormen, C.E. leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, Fourth Edition, PHI Private Limited, 2012
2. Anany Levitin, Introduction to the Design and Analysis of Algorithm, Third Edition, Pearson Education Asia, 2012
3. Juraj Hromkovic, Randomization and Approximation Algorithms, 2nd Edition, Springer , 2014

REFERENCES:

1. Sara Baase and Allen Van Gelder, Computer Algorithms Introduction to Design Analysis, Third Edition, Pearson Education, New Delhi, 2000
2. Obed Goldreich, P, NP, NP Completeness, Second Edition, Cambridge, 2010
3. A.V.Aho, J.E Hopcroft and J.D.Ullman, The Design and Analysis of Computer Algorithms ,Third Edition, Pearson Education Asia, 2012

3.11 212CSE3302: COMPUTER NETWORKS

212CSE3302	COMPUTER NETWORKS	L	T	P	X	C
		2	0	2	3	4
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To provide students with an overview of the concepts and fundamentals of data communication and computer networks.
- To introduce students to local, metropolitan and wide area networks are using the standard OSI reference model as a framework and to the Internet protocol suite and network tools and programming using various networking technologies.

COURSE OUTCOMES:

CO1: Understand the network model and analyze the various protocols in application layer.

CO2: Learn and identify the segmentation through TCP and UDP.

CO3: Inspect the basics of data communication and various categories of networks.

CO4: Identify the technologies for error free secure transmission of data in data link layer.

CO5: Apply various routing protocols to select optimal path and relate addressing entities in Network Layer.

CO6: Analyze the performance of various communication protocols using network tools.

CO7: Apply the knowledge acquired on various real time applications over internet.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S													
CO2	S													
CO3	S	M											M	
CO4	S	M											M	
CO5	S	M											M	
CO6	S				S									
CO7	S		S		M								S	M

UNIT I: INTRODUCTION TO NETWORKS AND APPLICATION LAYER

Introduction: Networks, Reference Model: TCP/IP and OSI , client-server, peer-to-peer network, overview of components of a network – devices, media and services (application) –end devices, intermediary network devices, NIC, gateways, Topology- physical and logical. Application Layer - Principles of network applications, DNS - Electronic Mail – FTP – HTTP - Next Generation Networks: Introduction - Vision, Scenarios - Requirements on Technology and Management - Functional Architecture - Introduction to tools: Wireshark, packet tracer.

UNIT II: TRANSPORT LAYER

Transport Layer - Need and Issues - Transport service - Elements of Transport Protocols Transport layer protocols - TCP and UDP, flow control, retransmission strategies, congestion control.

UNIT III: NETWORK LAYER

Network Layer - Need and Issues - Routing algorithms - Congestion Control Algorithms – QOS - Network Layer in Internet - Network Addressing – IPv4 IPv6-Configuration of Router - Distance Vector Routing – Link State Routing – RIP – OSPF – BGP - Subnetting – Classless Inter Domain Routing (CIDR) – Variable Length Subnet Mask (VLSM) – DHCP – ARP – Network Address Translation (NAT) – ICMP.

UNIT IV: DATA LINK LAYER

DLL: Need and Issues - Error Detection and Correction - Protocol Verification and Data Link Layer protocols - MAC Sub layer - Channel Allocation Problem - Multiple Access Protocols – Ethernet - Wireless LANs and VLAN - Data Link Layer Switching - Connectivity Devices - Configuration of Switches, ARP and RARP.

UNIT V: PHYSICAL LAYER

Physical Layer: Need and Issues, Data Communication, Guided transmission media, Wireless Transmission, Communication Satellites, Multiplexing and Switching.

15 WEEK COURSE PLAN

Week	Lecture (hours)	Pedagogy	Practical (2 hours)	X Component (3 hours)
Week 1	Introduction: Networks, TCP/IP and OSI.	PPT, Flash Animation	Study of Network Tool - packet tracer, wireshark	Impact of Networks in Day today life, Researching Converged Network Services.
Week 2	Client-Server, peer-to-peer network, overview of components of a network – devices, media and services (application) –end devices, intermediary network devices, NIC, gateways, Topology- physical and logical - Next Generation Networks - introduction - Vision, Scenarios - Requirements on Technology and Management - Functional Architecture.	Demonstration, PPT, Flipped Learning	Study of Network Devices in detail - Hub, Switch, Router. a) Building a Peer-to-Peer Network b) Examining Telnet and SSH	a) Help-Navigation b) Exploring internetworking devices

Week 3	Application Layer - Principles of network applications, DNS - Electronic Mail – FTP – HTTP. (Assignment - I).	PPT,Videos, Case Study-based Learning, Flipped Learning	Network Protocol analysis: a) Capture and Analyze DNS Packets. b) Capture and Analyze HTTP Packets	FTP Servers, DNS Servers, DHCP, Web server and Email server
Week 4	Transport Layer - Need and Issues - Transport service.	PPT	Network Protocol analysis: Capture and Analyze ICMP Packets.	Investigating the TCP/IP and OSI Models in Action
Week 5	Elements of Transport Protocols Transport layer protocols - TCP and UDP.	Videos, PPT, Flipped Learning	Network Protocol analysis: a) Capture and Analyze TCP Segment. b) Capture and Analyze UDP Datagram.	Observe the TCP 3-Way Handshake
Week 6	Flow control, retransmission strategies, congestion control. (Assignment - II).	Videos,PPT, Case Study-based Learning	Perform an experiment for port scanning with Nmap, Superscan or any other Software. a) Find open ports on a system b) Find the machines which are active	Examine a UDP DNS Capture
Week 7	Network Layer - Need and Issues - Routing algorithms - Congestion Control Algorithms – QOS - Network Layer in Internet.	Demonstration, PPT	Capture and Analyze IP Packets using wireshark.	Static Route Configuration

Week 8	Network Addressing – IPv4 and IPv6-Configuration of Router - Distance Vector Routing – Link State Routing – RIP – OSPF – BGP.	Case Study-based Learning, Problem solving, PPT	Exploring link state and distance vector routing protocols	Configuring a Linksys router
Week 9	Subnetting – Classless Inter Domain Routing (CIDR) – Variable Length Subnet Mask (VLSM) – DHCP – ARP – Network Address Translation (NAT) – ICMP. (Assignment - III).	Case Study-based Learning, Problem solving, PPT, Flipped Learning	a) To create a number of Subnet and assign the devices. b) To check the connectivity from one subnet to another subnet. c) To Configure the DHCP Server and provide a service to end device using different Gateways.	Designing and Implementing a VLSM Addressing Scheme
Week 10	DLL: Need and Issues - Error Detection and Correction - Protocol Verification and Data Link Layer protocols - MAC Sub layer.	Problem solving, PPT,Flipped Learning	To configure the Intra VLAN using packet tracer.	Identify MAC and IP Addresses, configure a small LAN
Week 11	Channel Allocation Problem - Multiple Access Protocols – Ethernet.	PPT,Flipped Learning	To configure the Inter VLAN using packet tracer.	Managing the Medium, Configuring Secure Passwords and SSH.

Week 12	Wireless LANs and VLAN - Data Link Layer Switching - Connectivity Devices - Configuration of Switches, ARP and RARP.	PPT,Videos	Checking Layer 2 functionality using packet tracer. a) Configure Spanning Tree Protocol b) Configure ARP and MAC Table.	Connecting a Wired and Wireless LAN, Examine the ARP Table.
Week 13	Physical Layer: Need and Issues, Data Communication.	PPT, Videos, Demonstration	Study of different types of Network cables and practically implement the Crossover wired and Straight through cable using Crimping Tool.	Scenario 1
Week 14	Guided transmission media, Wireless Transmission.	PPT, Videos, Flipped Learning	Topologies - Ring Topology, Mesh Topology, Tree Topology, Ring Topology	Trouble shooting default gateway
Week 15	Communication Satellites, Multiplexing and Switching.	PPT	Design and Build a Small Business Network	Trouble shooting connectivity issues on a network.

EXPERIMENTS:

1. Study of Network Tool - packet tracer, wireshark.
2. Study of Network Devices in detail - Hub, Switch, Router.
   a) Building a Peer-to-Peer Network.
   b) Examining Telnet and SSH.
3. Network Protocol analysis:
   a) Capture and Analyze DNS Packets.
   b) Capture and Analyze HTTP Packets.
4. Network Protocol analysis: Capture and Analyze ICMP Packets.
5. Network Protocol analysis:
   a) Capture and Analyze TCP Segment.
   b) Capture and Analyze UDP Datagram.

6. Perform an experiment for port scanning with Nmap, Superscan or any other Software.
   a) Find open ports on a system.
   b) Find the machines which are active.

7. Capture and Analyze IP Packets using wireshark.

8. Exploring link state and distance vector routing protocols.

9. a) To create a number of Subnet and assign the devices.
   b) To check the connectivity from one subnet to another subnet.
   c) To Configure the DHCP Server and provide a service to end device using different Gateways.

10. To configure the Intra VLAN using packet tracer.

11. To configure the Inter VLAN using packet tracer.

12. Checking Layer 2 functionality using packet tracer.
    a) Configure Spanning Tree Protocol.
    b) Configure ARP and MAC Table.

13. Study of different types of Network cables and practically implement the Crossover wired and Straight through cable using Crimping Tool.

14. Topologies - Ring Topology, Mesh Topology, Tree Topology, Ring Topology.

15. Design and Build a Small Business Network.

TEXT BOOK(S):

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education, 2017.

2. Larry Peterson Bruce Davie, "Computer Networks - A Systems Approach", 5th Edition by, Morgan Kaufmann, 2011.

3. Andrew S Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition Pearson Education, 2011.

4. Dr Jingming Li Salina, Pascal Salina. "Next Generation Networks Perspectives and Potentials", Wiley, 2007.

REFERENCES:

1. Todd Lammle, "CCNA Cisco Certified Network Associate Study Guide", 7th Edition, 2011.

2. B. S. Manoj, C. Siva Ram Murthy , "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, 2004.

3. Behrouz A. Forouzan, "Data Communications and Networking" Fourth Edition, McGraw-Hill, 2006.

4. William Stallings” Cryptography and Network Security: Principles and Practice”, 6th Edition, 2014.

5. William Stallings, “Data and Computer Communications”, 10th Edition, Pearson Education, 2014.

3.12 212CSE3303: OPERATING SYSTEM

212CSE3303	Operating System	L 3	T 0	P 2	X 0	C 4
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To learn modern operating systems and their principles.
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
- To learn, the details of processes, CPU scheduling, memory management, file system, storage subsystem, and input/output management.

COURSE OUTCOMES:

CO1: Understand and Interpret Operating System Structure, Operations, Services and Process.

CO2: Apply various scheduling algorithms for Process/CPU Scheduling and elaborate multithreaded programming

CO3: Apply different methods for handling deadlocks and elaborate process synchronization.

CO4: Analyze the efficiency of various page replacement algorithms for memory management.

CO5: Analyze the performance of disk scheduling algorithms and explore the concepts of protection and security

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S													
CO2	S													
CO3	S	M											M	
CO4	S	M											M	
CO5	S	M			L								M	L

UNIT I INTRODUCTION TO OPERATING SYSTEMS

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, Operating System structure - Layered, Monolithic, Microkernel operating systems, Operating system services, system calls, Network operating system, Distributed operating system, Concept of Virtual Machine. Installation of windows and Linux via Virtual Machine.

UNIT II PROCESS SCHEDULING

Definition, Process Relationship, Di?erent states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multi threads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Preemptive and Non preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCK

Operations on Processes, Cooperating Processes, Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Petersons Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Readers AND Writer's Problem, Dining Philosopher Problem etc. Deadlocks: Definition, Necessary and su?cient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Bankers algorithm, Deadlock detection and Recovery.

UNIT IV MEMORY MANAGEMENT

Memory Management: Basic concept, Logical versus Physical address space, Memory allocation: Contiguous Memory allocation-Fixed and variable partition- Internal and External fragmentation and Compaction; Segmentation: Basic Method- Segmentation Hardware. Paging: Principle of Operation-Page allocation-Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory- Hardware and control structures-Locality of reference, Page fault, Dirty page/Dirty bit, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).Allocation of frames,Thrashing.Implementaion of virtual memory in windows.

UNIT V FILE, SECONDARY STORAGE MANAGEMENT AND PROTECTION

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), e?ciency and performance.Protection AND Security: Protection- Goals of Protection, Domain of protection, Access Matrix, Access control, Implementation of Access Matrix, Revocation of Access Rights. Capability Based Systems, Language-based protection. Security: Security problems, Program Threats, System and network threats, Cryptography as a tool, user authentication, implementing security defence-Fire walling to protect system and networks, computer security classification.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical(2 hours)
Week 1	Introduction to Concept of Operating Systems,Generations of Operating systems, Types of Operating Systems,Operating System structure,Operating system services, system calls,Network operating system, Distributed operating system, Concept of Virtual Machine. Installation of windows and Linux via Virtual Machine.	Flipped Learning, PPT, Demonstration	Practicing windows and unix operating systems commands
Week 2	Definition, Process Relationship, Di?erent states of a Process, Process State transitions, Process Control Block (PCB, Context switching, Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multi threads	PPT	Creating the parent process and child process and check the order of executing in any real applications.

Week 3	Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time, Scheduling algorithms: Preemptive and Non preemptive, FCFS, SJF, RR; Multiprocessor scheduling	PPT,Problem Solving	Implement the CPU Scheduling to schedule the input process
Week 4	Operations on Processes, Cooperating Processes, Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Petersons Solution, The Producer Consumer Problem	PPT,Problem Solving	Implement the Simulation of Inter process Communication
Week 5	Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Readers and Writer's Problem, Dining Philosopher Problem	PPT, Problem Solving	Practing simple inter-process communication with signals
Week 6	Deadlocks: Definition, Necessary and su?cient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Bankers algorithm, Deadlock detection and Recovery.	PPT, Problem Solving, Case study	Hand-on session to implementation deadlock avoidance using Banker's algorithm with appropriate data structure.

Week 7	Memory Management: Basic concept, Logical versus Physical address space, Memory allocation: Contiguous Memory allocation-Fixed and variable partition- Internal and External fragmentation and Compaction; Segmentation: Basic Method- Segmentation Hardware. Paging: Principle of Operation-Page allocation-Hardware support for paging, Protection and sharing, Disadvantages of paging.	PPT,Problem Solving, Case Study	Hand-on session for Implementation of memory management functions.
Week 8	Virtual Memory: Basics of Virtual Memory- Hardware and control structures-Locality of reference, Page fault, Dirty page/Dirty bit, Demand paging.	peer learning, PPT, Problem Solving	Performing operations on data frames obtained from real time datasets
Week 9	Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).Allocation of frames,Thrashing. Implementaion of virtual memory in windows.	Problem Solving	Page replacement algorithms on real world memory management problems.
Week 10	I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	PPT, Problem Solving	Working with the scheduling of disk spaces using scheduling algorithms
Week 11	File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure	PPT	Hands-on session to create directory structure.

Week 12	Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), e?ciency and performance.	PPT, Problem Solving	Hands-on session on allocation of directory storage in real-time applications
Week 13	Protection and Security: Protection- Goals of Protection, Domain of protection, Access Matrix, Access control, Implementation of Access Matrix, Revocation of Access Rights. Capability Based Systems, Language-based protection.	PPT, Demonstration, Problem Solving	Practical hands-on session to the implementation of access control mechanisms.
Week 14	Security: Security problems, Program Threats, System and network threats	Case Study, Demonstration	Practical hands-on session to handle system and network threats.
Week 15	Cryptography as a tool, user authentication, implementing security defence Fire walling to protect system and networks, computer security classification	Demonstration, flipped Learning	Hands-on session on implementation of encryption algorithms

EXPERIMENTS:

1. Windows
   and UNIX Commands.
2. Simulation of System calls
3. Implementation of CPU Scheduling algorithms
4. Simulation of IPC in UNIX
5. Implementation of deadlock avoidance algorithms
6. Implementation of Page replacement algorithms
7. Implementation of memory management functions
8. Implementation of disk scheduling algorithms
9. Implementation of access control mechanisms

10. Implementation of encryption algorithms

TEXT BOOK(S):

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin,Greg Gagne, Wiley Asia Student Edition,2012.

2. Operating Systems: Internals and Design Principles, 6th Edition, William Stallings, Prentice Hall of India,2010.

REFERENCES:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing.

2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley.

3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India

4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati,O'Reilly and Associates

5. Operating systems- A Concept based Approach-D.M.Dhamdhere. 3rd Edition.TMH

6. Modern Operating Systems, Andrew S Tanenbaum 4rd edition PHI. 2015

7. Principles of Operating Systems, B.L.Stuart. Cengage learning, India Edition.

8. Operating Systems. A.S. Godboie.2nd Edition, TMH,2008

3.13 212CSE3304: AUTOMATA AND COMPILER DESIGN

212CSE3304	AUTOMATA AND COMPILER DESIGN	L	T	P	X	C
		3	0	2	0	4
Pre-requisite : Nil **Course Category :**Program Core **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- Understand the different mathematical models of computation.
- Design Finite Automata and recognize the Regular Expression and Languages.
- Explore the principles, algorithms, and data structures involved in the design and construction of compilers.

COURSE OUTCOMES:

CO1: Understand the different forms of proof and construct Finite Automata, Deterministic Finite Automata and Non-Deterministic Finite Automata.

CO2: Evaluate Regular Expression and Languages using Finite Automata and their types.

CO3: Understand the different phases of compilers and Evaluate Lexical Analysis.

CO4: Apply Various Parsing Techniques to the Context Free Grammar (CFG).

CO5: Create the Various Code Generation Schemes and apply the various optimization techniques for the generated code.

CO6: Analyze the Various Mathematical Computational Machine Model using JFLAP simulation tools.

CO7 : Implement all the Compiler Phases in programming language efficiently.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M											M	
CO2	S	M				L	L						M	
CO3	S	M				L	L						M	
CO4	S	M											M	
CO5	S	M	S	M	M	L	L						M	M
CO6	S	S	S	M	M		L						S	M
CO7	S	S			S		L						S	S

UNIT I: AUTOMATA

Introduction to formal proof – Additional forms of Proof - Inductive Proofs –Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions.

UNIT II: REGULAR EXPRESSIONS AND LANGUAGES

Regular Expression –Finite Automata and Regular Expressions – Properties of Regular languages: Pumping Lemma for Regular Languages and Applications – Closure Properties of Regular Languages- Equivalence of Automata.

UNIT III:INTRODUCTION TO COMPILER

Language processors - Structure of a compiler - Grouping of phases into passes- Compiler construction tools - Lexical Analysis: Role of Lexical Analyzer - Lexical Errors - Specification of tokens - Recognition of Tokens - Optimization of DFA based Pattern Matchers-LEX.

UNIT IV: PARSER

Introduction-Role of the parser - Error Handling and Recovery in Syntax Analyzer - Context-Free Grammars -Writing a Grammar-Top-Down parsing – Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing- Simple LR Parser – YACC.

UNIT V: CODE GENERATION AND OPTIMIZATION

Intermediate Code Generation: - Intermediate Languages, Variants of Syntax Trees - Three-Address Code: Types and Implementations - Code Optimization: Principal Sources of Optimization- Peephole Optimization. Code Generation: Issues in Design of a Code Generator - Basic Blocks and Flow Graphs - Optimization of Basic Blocks

15 WEEK COURSE PLAN

Course Chart	Lecture (4 hours)		Practical (2 hours)	
Weeks	Topic	Pedagogy	Topic	Pedagogy
Week 1	Introduction to formal proof	Explicit Teaching	Installing JFLAP Simulation Tool and perform proving techniques.	Demonstration
	Additional forms of Proof	Explicit Teaching		
	Inductive Proofs	Problem Solving		
Week 2	Finite Automata	Explicit Teaching	Design a DFA and NFA, Recognize the input string from Automata	Demonstration
	Deterministic Finite Automata (DFA)	Experiential Learning		
	Non-Deterministic Finite Automata (NFA)	Explicit Teaching		

<table>
<tr><td rowspan="3">Week 3</td><td>Conversion from NFA to DFA</td><td>Explicit Teaching</td><td rowspan="3">Automata Translation using JFLAP.</td><td rowspan="3">Demonstration</td></tr>
<tr><td>Finite Automata with Epsilon Transitions.</td><td>Explicit Teaching</td></tr>
<tr><td>Epsilon Closure and Conversion from Epsilon Transitions NFA to DFA.</td><td>Problem Solving</td></tr>
<tr><td rowspan="2">Week 4</td><td>Regular Expression, Properties of Regular languages.</td><td>Problem Solving</td><td rowspan="2">Building a Regular Expression</td><td rowspan="2">Demonstration</td></tr>
<tr><td>Finite Automata and Regular Expression</td><td>Explicit Teaching</td></tr>
<tr><td rowspan="3">Week 5</td><td>Conversion from Regular Expression to Automata</td><td>Problem Solving</td><td rowspan="3">Automata and Regular Expression Translation using JFLAP.</td><td rowspan="3">Experiential Learning and Demonstartion</td></tr>
<tr><td>Conversion from Automata to Regular Expression</td><td>Problem Solving</td></tr>
<tr><td>Automata Versus Regular Expression</td><td>Explicit Teaching</td></tr>
<tr><td rowspan="3">Week 6</td><td>Pumping Lemma for Regular Languages and Applications</td><td>Problem Solving</td><td rowspan="3">Proving languages not to be regular</td><td rowspan="3">Demonstration</td></tr>
<tr><td>Closure Properties of Regular Languages</td><td>Explicit Teaching</td></tr>
<tr><td>Equivalence of Automata</td><td>Problem Solving</td></tr>
<tr><td rowspan="3">Week 7</td><td>Language processors - Structure of a compiler</td><td>Explicit Teaching</td><td rowspan="5">Installing LEX tool. Simple Program using LEX, Performing Lexical Analyzer Operation from Source Language and Source Expression</td><td rowspan="5">Demonstration</td></tr>
<tr><td>Grouping of phases into passes- Compiler construction tools</td><td>Explicit Teaching</td></tr>
<tr><td>Lexical Analysis</td><td>Explicit Teaching</td></tr>
<tr><td rowspan="2">Week 8</td><td>Role of Lexical Analyzer - Lexical Errors</td><td>Explicit Teaching & Problem Solving</td></tr>
<tr><td>Specification of tokens, Recognition of Tokens</td><td>Explicit Teaching</td></tr>
<tr><td>Week 9</td><td>Optimization of DFA based Pattern Matchers</td><td>Explicit Teaching</td><td>Construction of Optimized DFA using direct method.</td><td>Problem Solving</td></tr>
</table>

	Problem based on Regular Expression to DFA using Direct Method	Explicit Teaching & Problem Solving		
	LEX			
Week 10	Introduction-Role of the parser - Error Handling and Recovery in Syntax Analyzer	Explicit Teaching	Build a CFG, Parse Tre and Ambiguous Grammar	Problem Solving
	Context-Free Grammars	Explicit Teaching		
	Writing a Grammar	Explicit Teaching		
Week 11	Top-Down parsing	Explicit Teaching & Problem Solving	Compute first and follow using predictive parsing and Construct a Predictive Parsing table	Experiential Learning
	Predictive Parsing	Experiential Learning		
	Construction of Predictive Parsing Table	Problem Solving		
Week 12	Bottom-up parsing - Shift Reduce Parsing	Explicit Teaching	Design a Shift Reduce Parsing, Construction of SLR Parsing	Demonstration
	Simple LR Parser Supervised Learning : Concepts and Examples	Explicit Teaching		
	YACC	Experiential Learning		
Week 13	Intermediate Code Generation: - Intermediate Languages, Variants of Syntax Trees	Explicit Teaching	Construct and implement the 3-address code from source language	Demonstration
	Three-Address Code: Types	Explicit Teaching		
	Three-Address Code: Implementations	Explicit Teaching		
Week 14	Code Optimization	Problem Solving	Implementations of Optimization Techniques	Demonstration
	Principal Sources of Optimization	Experiential Learning		
	Peephole Optimization	Explicit Teaching		
Week 15	Code Generation: Issues in Design of a Code Generator	Explicit Teaching	Generate Target code from Source Language and 3-address code.	Demonstartion
	Basic Blocks and Flow Graphs	Explicit Teaching		

	Optimization of Basic Blocks	Explicit Teaching		

EXPERIMENTS:

1. Installing JFLAP Simulation Tool and Perform Proving Techniques
2. Design a DFA and NFA, Recognize an input string from Automata
3. Automata Translation using JFLAP
4. Building a Regular Expression
5. Automata and Regular Expression Translation using JFLAP
6. Proving Language not to be Regular
7. Installing Lex, Simple Lex Program, Implementation of Lexical Analyzer
8. Construction of Optimized DFA using Direct Method
9. Building a CFG, Parse Tree and Ambiguous Grammar
10. Compute First and Follow Function using Predictive Parsing
11. Construction of Predictive Parsing Table
12. Design a Shift Reduce Parser
13. Construction of SLR Parsing Table
14. Generation of 3-address code
15. Implementation of 3-address code
16. Implementations of Optimization Techniques
17. Generation of Target Code

TEXT BOOK(S):

1. Introduction to Automata Theory, Languages and Computations, Hopcroft J.E, Motwani R and Ullman J.D, Pearson Education, Third Edition, 2011.
2. Compilers principles, techniques and tools, Alfred Aho, Ravi Sethi, V.Jeffery Ullman D, Pearson Education, Second Edition, 2018

REFERENCES:

1. Introduction to Languages and the Theory of Computation, Martin J, Tata Mc Graw Hill, 2003

2. Elements of The theory of Computation, Lewis H. R and Papadimitriou, Pearson Education, 2003

3. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.

4. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.

5. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill, 2003.

6. HenkAlblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.

7. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003

3.14 212CSE3305: SECURED COMPUTING

212CSE3305	SECURED COMPUTING	L	T	P	X	C
		2	0	2	3	3
Pre-requisite :NIL **Course Category :**Program Core **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the basics of cryptography
- To learn to identify the vulnerabilities in programs and to overcome them.
- To create awareness of the different kinds of Security threats in networks.
- To study the security threats in databases and the solutions available.
- To learn about the models and standards for security.

COURSE OUTCOMES:

CO1: Demonstrate knowledge of symmetric and asymmetric Encryption Algorithms like DES, AES and RSA, hash functions and digital signatures for protecting messages and data.

CO2: Secure programs and protect systems from malicious code.

CO3: Work with Firewalls, VPNs and IDSs to secure networks.

CO4: Identify the issues and solutions for implementing Security in Databases.

CO5: Demonstrate knowledge of Secure SDLC, Bell Lapadula and Biba models and ISO 27000 family of standards.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S				S									S
CO2	S	S			M								S	M
CO3	S	S	M										S	
CO4	S		M		M								M	M
CO5	S	S			S								S	S

UNIT I: ELEMENTARY CRYPTOGRAPHY

Terminology and background, Substitution ciphers, Transpositions, Making good encryption algorithms, Data Encryption Standard, AES encryption algorithm, Public key encryption, Cryptographic hash functions, Key exchange, Digital signatures Certificates.

UNIT II: PROGRAM SECURITY

Secure programs, Non-malicious program errors, Viruses, Targeted malicious code, Controls against program threat, Control of access to general objects, User authentication, Secure coding practices, Vulnerabilities in web applications.

UNIT III: SECURITY IN NETWORKS

Threats in networks, Threat analysis, Encryption, Virtual Private Networks, PKI,SSH,SSL, IPSec, content integrity, Access controls, Wireless security, Honey pots, Traffic flow security, Firewalls, Intrusion detection systems, Secure e-mail, Mobile Security. .

UNIT IV: SECURITY IN DATABASES

Security requirements of database systems, Reliability and integrity in databases, Two phase update, Redundancy / internal consistency, Recovery, Concurrency / consistency, Monitors, Sensitive data, Types of disclosures, Inference.

UNIT V: SECURITY MODELS AND STANDARDS

Secure SDLC, Secure application testing, Security architecture models, Trusted computing base, Bell LaPadula confidentiality model,Biba integrity model, Graham Denning access control model, Harrison Ruzzo Ulmanmodel, Secure frameworks,COSO, CobiT, Compliances, PCI DSS, Security standards, ISO 27000 family of standards.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	X Component (3 hours)
Week 1	Terminology and background	Direct instruction (PPT)	Breaking the Shift Cipher: To understand the principle of large key space so as to understand that the secure encryption is not possible with small key space. The system is easily broken if the total number of distinct secret keys is small, that is the key space K is small. In this experiment, we work with a well-known encryption scheme, namely the shift cipher, that has a very small key space. Your task is to break the shift cipher using brute force approach. Specifically, given only the cipher text in some instance of a shift cipher, you need to find the plain text and the secret key."
	Substitution ciphers	Interactive instruction (Problem solving)	
	Transpositions	Interactive instruction (Problem solving)	
	Making good encryption algorithms	Interactive instruction (Problem solving)	
Week 2	Data Encryption Standard	Direct instruction (PPT) Interactive instruction (Problem solving)	Breaking the Mono-alphabetic Substitution Cipher: To understand that just having a large key space is not enough to achieve secure encryption. In this experiment, we work with another well-known encryption scheme, namely the mono-alphabetic substitution cipher, that has a very large key space. However, it is quite easily broken using "Frequency analysis" methods. Your task is to break this cipher. Specifically, given only the ciphertext in some instance of a mono alphabetic substitution cipher, you need to find the plaintext and the secret key.
	AES encryption algorithm	Direct instruction (PPT), Interactive instruction (Problem solving)	
	Public key encryption	Direct instruction (PPT), Interactive instruction (Problem solving)	
Week 3	Cryptographic hash functions	Direct instruction (PPT) Interactive instruction (Problem solving)	Message Authentication Code:To understand the requirements of data integrity with the help of Secure Hash Algorithm 1 (SHA-1) which is a popular cryptographic hash function highly used in TLS,SSL,PGP,SSH,S/MIME,IPSec.In this experiment, we calculate the message digest of a text using the SHA-1 algorithm and thereby verifying data integrity.
	Key exchange	Direct instruction (PPT) Interactive instruction (Problem solving)	
	Digital signatures	Direct instruction (video)	
	Certificates	Direct instruction (Demonstration)	
Week 4	Secure programs	Direct instruction (Demonstration)	Symmetric Key Encryption with 48 bit key: To understand a symmetric-key block cipher algorithm known as Data Encryption Standard(DES). In this experiment, you are asked to perform encryption and decryption of the plain message using a 48 bit key which provides high security
	Non-malicious program errors	Direct instruction (Demonstration)	
	Viruses	Direct instruction (PPT)	
Week 5	Targeted malicious code	Direct instruction (PPT)	Symmetric Key Encryption with 128 bit key:To understand the need of highly secured symmetric encryption algorithm known as Advanced Encryption Standard (AES).In this experiment, you are asked to encrypt long messages using various modes of operation wherein a block cipher (AES) with 128 bit key is provided to you.

	Controls against program threat	Direct instruction (PPT)	
	Control of access to general objects	Direct instruction (PPT)	
Week 6	User authentication	Direct instruction (PPT)	Asymmetric Key Encryption : To understand the need of using different keys for encryption and decryption so as to achieve more security. In this experiment, you are asked to implement the popular asymmetric key algorithm RSA.
	Secure coding practices	Direct instruction (PPT)	
	Vulnerabilities in web applications	Direct instruction (PPT)	
Week 7	Threats in networks,Threat analysis	Direct instruction (PPT)	Secure Key exchange: To understand how to securely exchange the crypto graphic keys over Internet (Public channel). In this experiment, you are asked to implement Diffie-Hellman Key exchange mechanism.
	Encryption	Direct instruction (PPT)	
	Virtual Private Networks	Direct instruction (PPT)	
	PKI, SSH, SSL, Ipsec	Direct instruction (PPT)	
Week 8	Content integrity, Access controls	Direct instruction (PPT)	Digital Signature generation:To understand how to authenticate a message sent over the Internet using digital signature mechanism. In this experiment, you are asked to generate digital signature for the given message so as to ensure authenticity, integrity and non-repudiation.
	Wireless security	Direct instruction (PPT)	
	Honey pots	Direct instruction (PPT)	
	Traffic flow security	Direct instruction (PPT)	
	Firewalls	Flipped classroom	
Week 9	Intrusion detection systems	Flipped classroom	Firewall:To understand the security device which sits between public and private network and protects the network by filtering traffic. In this experiment, you are asked to simulate a Software-based Firewall System for Computer Network Traffic Control.
	Secure e-mail	Direct instruction (PPT)	
	Mobile Security	Direct instruction (PPT)	
Week 10	Security requirements of database systems	Direct instruction (PPT)	Intrusion Detection/Prevention System: To understand IDS/IPS system with the help of the Linux utility, snort. In this experiment, you are asked to configure snort to monitor your network traffic for intrusion attempts, log them, and report when an intrusion attempt is detected.
	Reliability and integrity in databases	Direct instruction (PPT)	
	Two phase update	Direct instruction (PPT)	

Week 11	Redundancy	Direct instruction (PPT)	Virus creation: To understand how virus is working and how it is a threat to computing system. In this experiment, you are asked to create a self replicating virus program in a Virtual Machine environment and test it in a Linux-based Virtual Machine.
	Internal consistency	Direct instruction (PPT)	
	Recovery	Direct instruction (PPT)	
Week 12	Concurrency / consistency–Monitors	Direct instruction (PPT)	Antivirus creation: For the virus created in week 11, create an antivirus which detects and alerts the system user about the virus. Test it in a Linux-based Virtual Machine.
	Sensitive data	Direct instruction (PPT)	
	Types of disclosures	Direct instruction (PPT)	
	Inference	Direct instruction (PPT)	
Week 13	Secure SDLC	Direct instruction (PPT)	Database security- Access control and authentication: To explore the security threats to database and the solution to protect the data in database against compromises of their confidentiality.In this experiment, you are asked to implement database security mechanisms by considering the following: Access control and authentication.
	Secure application testing	Direct instruction (PPT)	
	Security architecture models	Direct instruction (PPT)	
Week 14	Trusted computing base	Direct instruction (PPT)	Database security- Encryption and Integrity : To explore the security threats to database and the solution to protect the data in database against compromises of their integrity. In this experiment, you are asked to implement database security mechanisms by considering the following: Encryption and integrity controls
	Bell LaPadula confidentiality model	Direct instruction (PPT)	
	Biba integrity model	Direct instruction (PPT)	
	Graham Denning access control model	Direct instruction (PPT)	
	Harrison Ruzzo Ulmanmodel	Direct instruction (PPT)	
Week 15	Secure frameworks	Direct instruction (PPT)	Evaluation of X component by Quiz
	COSO-CobiT	Direct instruction (PPT)	
	Compliances	Direct instruction (PPT)	
	PCI DSS	Blended learning	

	Security standards-ISO 27000 family of standards	Independent study (Home-work)	

TEXT BOOK(S):

1. Charles P.Pfleeger, Shari Lawrence Pfleeger,"Security in Computing", Fourth Edition, Pearson Education, 2015.

REFERENCES:

1. 1. William Stallings, "Cryptography and Network Security: Principles and Practices", Prentice Hall, Fifth Edition, 2010.
2. 2. Michael Howard, David LeBlanc, John Viega, "24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them", McGraw Hill Osborne Media, First Edition, 2009.
3. 3. Matt Bishop, "Introduction to Computer Security", Addison-Wesley, 2004.
4. 4. Michael Whitman, Herbert J. Mattord, "Management of Information Security", Course Technology, Third Edition, 2010
5. 5. Matt Bishop, "Computer Security: Art and Science", Addison-Wesley, First Edition, 2002
6. 6. Michael Whitman, Herbert J. Mattord," Principles of Information Security", Cengage Learning, Fourth Edition, 2011.

4 PROGRAM ELECTIVE COURSES

STREAM: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

4.1 213CSE1301: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

		L	T	P	X	C
213CSE1301	**Introduction to Artificial Intelligence and Machine Learning**	4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand Artificial Intelligence concept and its applications.
- To gain knowledge regarding bayesian networks and its benefits in AI.
- To analyze various genetic algorithms and understand the basics of neural networks.
- To introduce the history of machine learning and to provide sufficient knowledge in choosing appropriate machine learning algorithms for the corresponding application.
- To explore various learning models.

COURSE OUTCOMES:

CO1: Understand the foundations and history of Artificial Intelligence, as well as the science of agent design.

CO2: Understand the probabilistic approaches to AI and apply them to solve real world problems.

CO3: Apply Evolutionary, Neural Network algorithms to solve complex problems.

CO4: Understand the origins of Machine learning and analyse the various types of algorithms with respect to the data.

CO5: Apply and analyze deterministic machine learning models on various real time data and build ability to implement the learning algorithms.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

PO'S													PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M	L	M									S	L
CO2	S	S	S	M									S	M
CO3	S	S	S	S					M	L		S	S	S
CO4	S	S	S	S									S	M
CO5	S	S	S	S	L	L	L	L	M	L	L	S	S	S

UNIT I: Introduction to Artificial Intelligence, Logistic Approach & Knowledge based Systems

History of Artificial Intelligence, Emergence of AI, Cognitive Science and AI.Basics of Propositional Logic- Syntax, Semantics, Tautologies and Logical Implication, Logical Arguments, Derivation Systems, Resolution in normal forms, derivations using resolutions and resolution algorithm. Artificial Intelligence Applications- Knowledge-Based Systems, Wumpus World. Taxonomic Knowledge- Semantic Nets, Model of Human Organization of Knowledge, Frame data structure, planning using frames. Non-monotonic Logic- Circumscription, Default Logic, Difficulties.

UNIT II: Probabilistic Approach to AI

Probability Basics- Probability Spaces, Conditional Probability and Independence, Bayes' Theorem; Meaning of probability, Relative frequency and subjective approaches. Random Variables- Probability Distributions of Random Variables, Independence of Random Variables, Random variables in applications. Bayesian Networks -Definition, properties and representation; Inference, Algorithms and packages, Inference using Netica; Casuality and Markov condition in networks. Networks with Continuous Variables- Gaussian Bayesian Networks, Hybrid Networks. Obtaining the Probabilities in a Bayesian Network: Difficulty Inherent in Multiple Parents, Basic Noisy OR-Gate Model, Leaky Noisy OR-Gate Model. Large-Scale Application of Bayesian Networks: Promedas.

UNIT III: Evolutionary Intelligence, Neural Networks & Natural Language Understanding

Genetics Review. Genetic Algorithms: Algorithm Description, Illustrative Examples, Travelling Salesperson Problem; Ant system, Ant colonies and Artificial Ants for TSP, Flocks, application to Financial trading. Basic understanding of Neural Networks, Functional structure of neural networks. Understanding of Natural Language Understanding, Parsing, Semantic Interpretation, Concept/Knowledge Interpretation.

UNIT IV: Introduction to Machine Learning

The Origins of Machine Learning. Uses and Abuses of Machine Learning. How do Machines Learn? - Abstraction and Knowledge Representation, Generalization. Assessing the Success of Learning 4 Steps to Apply Machine Learning to Data. Choosing a Machine Learning Algorithm - Thinking about the Input Data, Thinking about Types of Machine Learning Algorithms, Matching Data to an Appropriate Algorithm.

UNIT V: Learning Deterministic Models

Supervised Learning- Concepts and Examples. Regression- Simple Linear Regression, Multiple Linear Regression, Overfitting and Cross Validation. Parameter Estimation- Estimating the Parameters for Simple Linear Regression, Gradient Descent, Logistic Regression and Gradient Descent. Learning a Decision Tree: Information Theory, Information Gain and the ID3 Algorithm. Unsupervised Learning: Clustering, Automated Discovery. Reinforcement Learning: Multi-Armed Bandit Algorithms, Dynamic Networks. Decision Trees, Influence diagrams, Risk Modelling, Sensitivity Analysis. Structured Learning problems, score based structure learning, constraint based structure learning. Casual Learning – casual faithful assumption, embedded faithfulness,Information Retrieval, Data Scraping from Web sources, Scrapy in Python.

15 WEEK COURSE PLAN

Course Chart / Weeks	Lecture (2 hours)		Practical (2 hours)	
	Topic	Pedagogy	Topic	Pedagogy
Week 1	History of Artificial Intelligence-What is AI?- Emergence of AI	Explicit Teaching	Introduction to Netica	Demonstration
	Cognitive Science and AI – Logical Approach to AI and Knowledge based systems – Basics of Propositional Logic: Syntax, Semantics	Explicit Teaching		
	Tautologies and Logical Implication, Logical Arguments, Derivation Systems	Explicit Teaching		
Week 2	Resolution in normal forms, derivations using resolutions and resolution algorithm	Explicit Teaching	Network Construction in Netica	Demonstration
	Artificial Intelligence Applications: Knowledge-Based Systems, Wumpus World	Experiential Learning		
	Taxonomic Knowledge: Semantic Nets	Explicit Teaching		

Week 3	Model of Human Organization of Knowledge, Frame data structure, planning using frames	Explicit Teaching	Simulating Networks in Netica	Demonstration
	Non-monotonic Logic: Circumscription	Explicit Teaching		
	Default Logic, Difficulties	Explicit Teaching		
Week 4	Probability Basics: Probability Spaces, Conditional Probability and Independence	Problem Solving	Inference using Netica; Casuality and Markov condition in networks	Problem Solving
	Bayes' Theorem; Meaning of probability, Relative frequency and subjective approaches	Explicit Teaching		
Week 5	Random Variables: Probability Distributions of Random Variables	Problem Solving	Hands-on Session on Pandas, Matplotlib, Numpy	Experiential Learning
	Independence of Random Variables, Random variables in applications	Explicit Teaching		
	Bayesian Networks -Definition, properties and representation; Inference, Algorithms and packages	Explicit Teaching		
Week 6	Networks with Continuous Variables: Gaussian Bayesian Networks, Hybrid Networks	Problem Solving	Data Scraping using BeautifulSoup	Demonstration
	Obtaining the Probabilities in a Bayesian Network: Difficulty Inherent in Multiple Parents	Explicit Teaching		
	Basic Noisy OR-Gate Model, Leaky Noisy OR-Gate Model	Problem Solving		
Week 7	Large-Scale Application of Bayesian Networks: Promedas	Explicit Teaching	Scraping data from websites: Flipkart, Espncricinfo, Pubmed	Demonstration

	Genetics Review – Genetic algorithms – Algorithm Description, Illustrative Examples	Explicit Teaching		
	Travelling Salesperson Problem; Ant system	Explicit Teaching		
Week 8	Ant colonies and Artificial Ants for TSP	Explicit Teaching & Problem Solving		
	Flocks, application to Financial trading	Explicit Teaching		
Week 9	Neural Networks, Natural Language Understanding: Basic understanding of Neural Networks	Explicit Teaching	Evaluation: Data Scraping	Problem Solving
	Functional structure of neural networks Understanding of Natural Language Understanding	Explicit Teaching & Problem Solving		
	Parsing, Semantic Interpretation, Concept/ Knowledge Interpretation			
Week 10	The Origins of Machine Learning –	Experiential Learning	Hands on Session on Sklearn	Experiential Learning
	How do Machines Learn? - Abstraction and Knowledge Representation, Generalization	Explicit Teaching		
	Assessing the Success of Learning	Explicit Teaching		
Week 11	4 Steps to Apply Machine Learning to Data	Explicit Teaching & Problem Solving	Hands on Session on Sklearn	Experiential Learning
	Choosing a Machine Learning Algorithm - Thinking about the Input Data	Experiential Learning		
	Thinking about Types of Machine Learning Algorithms	Experiential Learning		
Week 12	Matching Data to an Appropriate Algorithm	Explicit Teaching	Linear Regression	Demonstration

	Learning Deterministic Models Supervised Learning : Concepts and Examples	Explicit Teaching		
	Regression: Simple Linear Regression	Experiential Learning		
Week 13	Multiple Linear Regression, Over fitting and Cross Validation	Explicit Teaching	Logistic Regression	Demonstration
	Parameter Estimation: Estimating the Parameters for Simple Linear Regression	Explicit Teaching		
	Gradient Descent, Logistic Regression and Gradient Descent	Explicit Teaching		
Week 14	Learning a Decision Tree: Information Theory, Information Gain and the ID3 Algorithm	Problem Solving	Decision Tree Learning	Demonstration
	Unsupervised Learning: Clustering, Automated Discovery	Experiential Learning		
	Reinforcement Learning: Multi-Armed Bandit Algorithms, Dynamic Networks	Explicit Teaching		
Week 15	Decision Trees, Influence diagrams, Risk Modelling, Sensitivity Analysis	Explicit Teaching	ML Model Building using Scraped Data	Project Based Learning
	Structured Learning problems, score-based structure learning, constraint-based structure learning	Explicit Teaching		
	Casual Learning – casual faithful assumption, embedded faithfulness	Explicit Teaching		

EXPERIMENTS:

1. Web Scraping - Scrapy
2. Linear Regression

3. Lasso Regression
4. Ridge Regression
5. Logistic Regression
6. Polynomial Regression
7. Decision Tree Learning
8. Partition Clustering
9. Hierarchical Clustering
10. Realtime Data Modelling – Project

TEXT BOOK(S):

1. Introduction to Artificial Intelligence and Machine Learning (IBM ICE Publications)

REFERENCES:

1. Stuart Russel and Peter Norvig, Artificial Intelligence- A Modern Approach, 3rd Edition, Pearson Education/Prentice Hall of India, 2016.
2. Elaine Rich andKevin Knight, Artificial Intelligence, 2nd Edition, Tata McGraw-Hill, 2013 (4th Edition).
3. Neeta Deshpande and Nanda Yadav, Artificial Intelligence, Technical Publications, Pune, 2008.
4. George F. Luger, Artificial Intelligence- Structures and Strategies for Complex Problem Solving, 2nd Edition, Pearson Education/PHI, 2010.

4.2 213CSE2301: PREDICTIVE ANALYSIS

213CSE2301	**Predictive Analytics**	**L** 4	**T** 0	**P** 2	**X** 0	**C** 4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand data mining concepts, applications and challenges.
- To provide knowledge on data visualization and various distributions.
- To detect outliers, remove duplicates and partition the data.
- To explore various model development techniques.
- To validate a model, access its performance and update it.

COURSE OUTCOMES:

CO1: Understand the concepts, models and technologies behind data mining.

CO2: Apply mining and statistical techniques to visualize relationships between data.

CO3: Apply data preparation techniques to process aggregate data, missing data, duplicate data and cached data.

CO4: Apply and analyze various data modelling techniques on real-time data.

CO5: Evaluate and deploy models by assessing the performance of the model.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	L	L									S	L
CO2	S	M	L	M									S	M
CO3	M	M	M	S					L			M	S	M
CO4	S	S	S	S	L	L	L	L	M	L	L	S	S	M
CO5	S	S	S	S					L	L		S	S	S

UNIT I: Introduction to Data Mining

Introduction, What is Data Mining?, Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on different kinds of data, Applications of Data Mining, Challenges of Data Mining.

UNIT II: Understanding and Preparation-I

Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data, R Programming Constructs, Functional Programming, Map, Reduce, Filter.

UNIT III: Understanding and Preparation-II

Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values, Data Visualization, Tableau, Animations, Dashboard.

UNIT IV: Model Development and Techniques

Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

UNIT V: Model Evaluation and Deployment

Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Meta-Level Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

15 WEEK COURSE PLAN

Course Chart / Weeks	Lecture (2 hours)		Practical (2 hours)	
	Topic	Pedagogy	Topic	Pedagogy
Week 1	Introduction, what is Data Mining?	Explicit Teaching	Introduction to Tableau and its usecases	Demonstration
	Concepts of Data mining, Technologies Used	Experiential Learning		
	Data Mining Process, KDD Process Model	Explicit Teaching		
Week 2	CRISP – DM, Mining on different kinds of data	Explicit Teaching & Animation	Data Representation in Tableau	Demonstration
	Applications of Data Mining	Experiential Learning		
	Challenges of Data Mining	Explicit Teaching		
Week 3	Introduction, Reading data from various sources	Demonstration	Data Visuallization in Tableau	Demonstration
	Data Visualization	Demonstration		
	Distributions and summary statistics			
Week 4	Relationships among variables	Explicit Teaching	Creating Animations with Data Streams	Demonstration
	Extent of Missing Data	Explicit Teaching		
Week 5	Segmentation, Outlier detection	Explicit Teaching	Evaluation: Data Visualization using Tableau	Problem Solving
	Automated Data Preparation	Explicit Teaching		
Week 6	Duplicate Removal	Explicit Teaching	Introduction to R	Explicit Teaching & Demonstration
	Sampling DATA			
Week 7	Data Caching	Explicit Teaching	Introduction to R	Explicit Teaching & Demonstration

	Partitioning data, Missing Values	Explicit Teaching		
Week 8	Data Partitioning, Model selection	Explicit Teaching	Data preparation in R	Explicit Teaching & Demonstration
	Model Development Techniques, Neural networks	Explicit Teaching		
Week 9	Decision Trees	Explicit Teaching & Problem Solving	Functional Programming in R	Explicit Teaching & Demonstration
Week 10	Logistic Regression	Explicit Teaching		
	Discriminant Analysis	Explicit Teaching & Problem Solving	Decision Trees in R	Demonstration
Week 11	Support vector machine	Explicit Teaching	Logistic Regression in R	Demonstration
Week 12	Bayesian Networks	Explicit Teaching	SVM in R	Demonstration
	Linear Regression, Cox Regression, Association rules	Explicit Teaching & Problem Solving		
Week 13	Introduction, Model Validation	Experiential Learning	Linear Regression in R	Demonstration
	Rule Induction Using CHAID	Explicit Teaching		
Week 14	Automating Models for Categorical and Continuous targets	Explicit Teaching	Apriori Mining in R	Demonstration
	Comparing and Combining Models	Experiential Learning		
	Evaluation Charts for Model Comparison	Explicit Teaching		
Week 15	Meta-Level Modeling, Deploying Model	Explicit Teaching	Data Modeling using R	Project Based Learning

	Assessing Model Performance, Updating a Model	Explicit Teaching		

EXPERIMENTS:

1. R Programming Basics – Hands-on
2. Matrices in R
3. Introduction to dplyr Package
4. Introduction to ggplot Package
5. Association Rule Mining – Apriori
6. k Means Clustering Algorithm
7. Hierarchical Clustering Algorithm
8. Cox Regression
9. Support Vector Machine (SVM)
10. Tableau – Data Visualization
11. Animations in Tableau
12. Dashboard – Case study

TEXT BOOK(S):

1. Data Mining and Predictive Modeling (IBM ICE Publications)

REFERENCES:

1. Bruce Ratner, Statistical and Machine-Learning Data Mining, CRC Press, 2011
2. Eric Siegel & Thomas H. Davenport, Predictive Analytics, Wiley Publications, 2013
3. James Wu and Stephen Coggeshall, Foundations of Predictive Analytics, CRC Press, 2012

4.3 213CSE2302: ALGORITHM FOR INTELLIGENT SYSTEMS AND ROBOTICS

		L	T	P	X	C
213CSE2302	**ALGORITHM FOR INTELLIGENT SYSTEMS AND ROBOTICS**	4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the Principles of Control Systems.
CO2: Applying Machine Learning in Decision Making.
CO3: Optimization using Numerical Methods in Search.
CO4: Appling Neural Networks in Control Systems.
CO5: Applying the principles of Reinforcement Learning in Robotics.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M	S	S	M			L	L	L	L	L	S	L
CO2	S	M	S	S	S		S	L	M	M	L	L	S	M
CO3	M	M	S	S	M			L	L	L		L	S	L
CO4	M	M	M	M	M			L	M	M		L	S	S
CO5	M	S	S	S	S	L	S	L	L	M	S	L	S	S

UNIT I: System Modeling Introduction, Biological and cognitive paradigms for robot design, Declarative-Procedural-Reflexive hierarchy for decision making and control, Articulated robots, Joint-Link (Denavit-Hartenberg) transformations, Mobile ground robots, Uninhabited ground robots, Intelligent agents, Open-loop and closed-loop systems.

UNIT II: Artificial Intelligence for Robotics Engineering Artificial intelligence, Well-known definitions for AI, Birth of AI, Basic terminologies, Applications of AI, The AI problems and techniques, Real world problems, State space search, Explicit vs. Implicit state space, State space search notations, Search problem and problem space, Representation of search problems, State space search example, Pegs and disks problem, 8 queen's problem, N queens problem formulation, 8 puzzle problem, State space search example: Tic-tac-toe problem, Production systems, Commutative production system, Problem characteristics, Search paradigm, Classification of search algorithms, General terminologies, Uninformed search algorithms, Breadth first search, BFS illustration, Depth first search, DFS illustrations, Depth Limited Search (DLS), Depth first iterative deepening search and bi-directional search, Comparing the uninformed search algorithms, Informed search algorithms, Heuristic search techniques, Generate-and-test, Hill climbing, Algorithm for simple hill climbing, Best first search, Knowledge representation, Knowledge representation languages, Framework for knowledge representation, Knowledge representation schemes, Properties and schemes for knowledge representation, Relational based knowledge representation scheme, Inheritable knowledge representation scheme, Inferential knowledge representation scheme, Declarative/procedural knowledge, Planning, Representation of states, goals and actions, Goal stack planning.

UNIT III: Components of an Intelligent Robotic System Introduction to robotics, Types of robots, Classification of robots, Components of robot, Manipulation arms, Merits and demerits of robot types with different geometries, Wrists, Robot kinematics, Homogenous transformation modelling convention, Example of forward kinematics, Inverse kinematics, Algebraic solution approach: Example, Advanced robotics, Machine intelligence: Architectures, controllers and applications, Architectures for intelligent control, Machine learning, Machine learning: Rule-based control, Machine learning: Machine learned control, Machine learning: Reinforcement learning, Advanced control systems for robotic arms, Kinematic and dynamic control, Intelligent gripping systems, Overview of the Salford theories, Need and provision of fingertip sensor system, Computer software package implementation, Force feedback control in robots and its application to decommissioning, Force feedback strategies, Introduction to mobile robots, Environment capturing with common sensors, CCD cameras, CCD Vs. CMOS, Sonar sensors, Optoelectronic sensors, Sensor integration, Qualitative approaches, Quantitative approaches, Bayes statistics, Kalman filter, Machine vision system, Phases of a machine vision system, Tool condition monitoring systems, Neural networks for tool condition monitoring systems, Basic understanding of neural networks, Representational power of perceptrons, Architecture of neural networks, Single-layer feed-forward architecture, Multiple-layer feed-forward architecture, Recurrent or feedback architecture, Mesh architecture, The perceptron training rule, Gradient descent and the delta rule, Gradient descent algorithm, Stochastic approximation to gradient descent, Multilayer networks and back-propagation algorithm, The back-propagation algorithm, Multiple principal component fuzzy neural networks, Fuzzy classification and uncertainties in tool condition monitoring.

UNIT IV: Robot Operating System (ROS) Real and simulated robots, Robot Operating System (ROS), ROS basics and architecture, The File system level, Files and folders in a sample package of ROS, ROS packages, ROSbash, package.xml, ROS messages, ROS services, The computational graph level, The community level, Debugging and visualization, Using sensors and actuators, 3D modeling and simulation, Computer vision.

UNIT V: Navigation, SLAM and Speech Recognition and Synthesis Navigation, Simultaneous localization and mapping, setting up rviz for navigation stack, Adaptive Monte Carlo Localization, Avoiding obstacles, Speech recognition and synthesis.

TEXT BOOK(S):

1. 1. Algorithms for Intelligent Systems and Robotics (IBM ICE Publications)

4.4 213CSE2303: COMPUTATIONAL LINGUISTICS AND NATURAL LANGUAGE PROCESSING

213CSE2303	**COMPUTATIONAL LINGUISTICS AND NATURAL LANGUAGE PROCESSING**	**L**	**T**	**P**	**X**	**C**
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understanding the principles of Natual Language Processing.
CO2: Study of Semantic analysis in Natual language processing.
CO3: Appling statistical technique in linguistic analysis.
CO4: Analysis of documents based on Distance measures similarity measures.
CO5: Application of Information Retrieval algorithms.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

PO'S													PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M	S	S	M			L	L	L	L	L	S	M
CO2	M	S	M	M	M		M	M	M	M	M	L	S	L
CO3	M	S	M	M	S			L	M	M		L	S	S
CO4	M	M	M	M	M			L	M	M		S	S	M
CO5	M	L	M	M	S	M	M	L	L	M	S	L	S	S

UNIT I: Classical Approaches of NLP Introduction, Classical approaches to natural language processing, Approaches to natural language processing, Understanding linguistics, Level 1: Morphology, Level 2: Syntax, Level 3: Semantics, Level 4: Pragmatics, Understanding linguistics, Traditional approach, Example: Automatic summarization using NLP, Drawbacks, Text processing, What Is text processing? Text analysis vs. Text mining vs. Text analytics, Tools and methodologies: Statistical methods, Tools and methodologies: Text classification, Tools and methodologies: Text extraction, Tools and methodologies: Example, Scope of text analysis/processing, Importance of text analysis, Working principles of text analysis, Data gathering, Data preparation, Data preparation steps, Data analysis, Evaluation of text classification process, Text extraction, Analysis in test extraction, Evaluation of text extraction process, Text analysis APIs, Levels of NLP, Lexical analysis, Pre-processing activity, POS tagging, Syntactic parsing, Types of parsing, Derivation logic, Grammar, Semantic analysis, Semantic analysis elements, Representation in semantic analysis, Natural language generation, NLP vs NLG, History of NLG, Working principle of natural language generation, Limitations in natural language generation.

UNIT II: Empirical Approaches Corpus creation, Corpus linguistics, Types of corpora, Lexicographical implementations in corpora, Timeline of corpus linguistics, Usage areas of corpora, Traits of a good text corpus, Annotations in text corpus, NLP task-specific training corpora, Data sets used for natural language processing, Treebank annotation, Linguistic description layers, Areas using text annotations, Usage of annotations and corpora, Kinds of annotations, Annotation semantic labels, Annotations in machine learning, Annotation development cycle, Model creation, Create annotations, Training and testing the algorithms, Result evaluation, Revision of the model, Tree banks and its construction, Need for tree bank, Types of tree bank corpus, Phrase structured vs dependency structured tree bank, Fundamental statistical techniques, Problems of the traditional approach, How statistics helps, Problems of the traditional approach and how statistics helps, Hidden Markov model, Maximum entropy Markov model, Conditional random field model, Support vector machine, N-GRAM, Genetic algorithm, POS Tagging, Word sense disambiguation, POS tag and Tagsets, Types of POS taggers, Markovian model, Hidden Markov model, POS tagging using HMM.

UNIT III: Statistical Approaches Parsing, Statistical parsing, Approaches to parsing, Statistical approach, Lexicalized statistical parsing, Top-down parsing, Bottom-up parsing, Left corner parsing method, Statistical parsing: Probabilistic parser, Multiword expressions, Features of MWE, Types of multi word expressions, Multi word verbs, Word similarity and text similarity, Text similarity methods, Jaccard similarity, K-means, Cosine similarity, Word Mover's distance, Variational auto encoders, Pre-trained sentence encoders, Bidirectional Encoder Representations from Transformers (BERT) with cosine distance, Word sense disambiguation, Complications in WSD, Methods in WSD, Evaluation of WSD, History of speech recognition technology, Working principle in voice recognition, Major leaders in speech recognition and voice assistant, Amazon Alexa, Microsoft Cortana, Google Assistant, Machine translation, Rule-based machine translation, Statistical machine translation, Rule-based MT vs. statistical MT, Working principle of SMT, Challenges with statistical machine translation.

UNIT IV: Applications of Natural Language Processing Information retrieval, Information retrieval in NLP, IR development, Model types, Model types: Mathematical basis model, Problems with NLP in information retrieval, NLP in information retrieval, IR evaluation metrics, Information Retrieval (IR) model and types, Design features of IR systems, Design features of IR systems, Question answering systems, QA system architecture, QA system types, Text based QA systems, Factoid question answering system, Web based question answering system, Information retrieval or information extraction based QA systems, Restricted domain question answering, Rule based question answering systems, Information extraction, Working of information extraction, Information extraction applications, Chunking, Representing chunks: Tags vs trees, Report generation, Text report specifications, Features of reports, Report generation process, Usage of NLP text in report generation, Ontology construction, Ontology classifications and process, Why ontology and its advantages, Ontology components, Levels of formality, Ontology construction approaches, Ontology construction.

UNIT V: Emerging Applications of Natural Language Generation in Information Visualization, Education, and Health Care Multimedia presentation generation, Focus points to add multimedia in NLG, Text generation: Meaning representation, Text generation: Document structure design, Text generation: Linguistic style control, Document layout, Layout and meaning representation, Layout style and wording representation, Image style and meaning representation, Image and wording usage, Scripted dialogue, Language interfaces for intelligent tutoring systems, CIRCSIM-Tutor, CIRCSIM-Tutor architecture, data presentation and process cycle, AUTOTUTOR, AUTOTUTOR architecture and process, ATLAS Andes, Andes system architecture and design, Pedagogical considerations in Andes, WHY2-ATLAS, Why 2 Atlas architecture and process, Argumentation for healthcare consumers, CDS architecture and processing, NLP for CDS scope, NLP models, Building blocks of NLP - CDS, Data based evidence collection: Summarization, Applications of NLP in healthcare, Sentiment analysis and subjectivity, Difficulties in sentiment analysis, Document level sentiment classification, Sentence level sentiment classification, Lexicon, Feature-based sentiment analysis, Opinion summarization.

EXPERIMENTS:

1. Text Retrieval
2. Processing, Subsetting, Merging and Cleaning Text Data
3. Simple Language Processing using Spacy
4. Language Processing
5. Accessing Text Corpora
6. Processing Raw Text
7. Categorizing and Tagging Words
8. POS Tagging using NLTK Treebank
9. Tagging and Parsing
10. Analysing Text Similarity
11. Analysing Word Sense
12. Analysing Meaning of Words and Sentences
13. POS tagging with Rule Based Viterbi Implementation
14. Machine Translation
15. Information Retrieval from Corpus
16. Information Answering QA system – Rule Based Text Analysis
17. Information Extraction from Text
18. Relation Extraction using Subtree Matching
19. Information Extraction from a Text Corpus
20. Analysis of Sentiment and Subjectivity
21. Analysing Meaning of Sentences

TEXT BOOK(S):

1. Computational Linguistic and Natural Language Processing (IBM ICE Publications).

4.5 213CSE3301: DEEP LEARNING

213CSE3301	DEEP LEARNING	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the background and concept of Deep learning.
CO2: Understand and apply Single layer and Multi layer perceptron networks to solve complex learning problems efficiently.
CO3: Apply Regularization and Optimization criterions to improve performance of learning models.
CO4: Understand and apply stochastic learning models to solve complex problems.
CO5: Understand the power of dynamically driven recurrent networks and apply them over real time datasets.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	M	L	L									S	S
CO2	S	M	S	M	L								S	S
CO3	S	M	S	S	L				L			M	S	S
CO4	S	S	S	S	M	L	L	L	M	L	L	S	S	S
CO5	S	S	S	S	M				L	L		S	S	S

UNIT I: Introduction and Learning Processes Description of a Neural Network, Human Brain, Models of a Neuron, Neural Networks Viewed as Directed Graphs, Feedback, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks, Error-Correction Learning, Memory-Based Learning, Hebbian Learning, Competitive Learning, Boltzmann Learning, Supervised and Unsupervised Learning, Learning Tasks, Memory and Adaptations, Statistical Nature of the Learning Process, Statistical Learning Theory, Probably Approximately Correct Model of Learning

UNIT II: Single Layer Perceptrons and Multilayer Perceptrons Adaptive Filtering Problems, Unconstrained Optimization Techniques, Linear Least-Squares Filters, Least-Mean-Square Algorithms, Learning Curves, Learning Rate Annealing Techniques, Perceptrons, Perceptron Convergence Theorem, Relation between the Perceptron and Bayes Classifier for a Gaussian Environment, Continuous Latent Variables, Pattern Recognition in Sequential Data, Combining Models for Pattern Recognition, Preliminary Concepts, Backpropagation Algorithm, XOR Problem, Heuristics for Making Backpropagation Algorithm Perform Better, Output Representation and Decision Rules, Feature

Detection, Backpropagation and Differentiation, Hessian Matrix, Generalization, Approximations of Functions, Cross-Validations, Network Pruning Techniques, Virtues and Limitations of Backpropagation Learning, Accelerated Convergence of Backpropagation Learning, Supervised Learning Viewed as Optimization Problem.

UNIT III: Radial-Basis Function Networks and Information-Theoretic Models
Cover's Theorem on the Separability of Patterns, Interpolation Problem, Regularization Theory and Regularization Networks, Generalized Radial-Basis Function Networks, Estimation of the Regularization Parameter, Approximation Properties of RBF Networks, Comparison of RBF Networks and Multilayer Perceptrons, Kernel Regression and its Relation to RBF Networks, Learning Strategies in RBF Networks, Entropy, Maximum Entropy Principle, Mutual Information, Kullback-Leibler Divergence, Mutual Information as an Optimization Function, Maximum Mutual Information Principle, Infomax and Redundancy Reduction, Spatially Coherent Features, Spatially Incoherent Features, Independent Components Analysis, Maximum Likelihood Estimation Technique, Maximum Entropy Method.

UNIT IV: Stochastic Machines Statistical Mechanics, Markov Chains, Metropolis Algorithm, Simulated Annealing, Gibbs Sampling, Boltzmann Machines, Sigmoid Belief Networks, Deterministic Boltzmann Machine, Deterministic Sigmoid Belief Networks, Deterministic Annealing

UNIT V:Dynamically Driven Recurrent Networks Recurrent Network Architectures, State-Space Model, Nonlinear Autoregressive with Exogenous Inputs Model, Computational Power of Neural Networks, Learning Algorithms, Backpropagation through Time, Real-Time Recurrent Learning, Vanishing Gradients in Recurrent Networks.

TEXT BOOK(S):

1. Deep Learning (IBM ICE Publications).

4.6 213CSE4301: PATTERN AND ANOMALY DETECTION

213CSE4302	PATTERN AND ANOMALY DETECTION	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understanding the concepts in pattern matching problems.
CO2: Apply Statistical methods for Patten matching.
CO3: Applying Machine Learning Methods in Pattern Matching.
CO4: Analyse data analytics method in pattern recognition.
CO5: Understanding hybrid models.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M	S	S	S			M	L	L	L	L	S	L
CO2	M	S	L	S	S		M	M	M	L	L	M	S	M
CO3	L	M	M	M	S		M	L	L	M		L	S	S
CO4	M	M	M	M	M			M	L	M		L	S	M
CO5	M	L	M	M	S	M	M	L	L	M	S	L	S	M

UNIT I: INTRODUCTION Introduction to Pattern Recognition and Anomaly Detection, Example: Polynomial Curve Fitting, Probability Theory, Model Selection, The Problem with High Dimensionality, Information Theory.

UNIT II: Statistical Approaches for Pattern Recognition Probability Distributions, Linear Models for Regression, Linear Models for Classification.

UNIT III: Machine Learning Approaches for Pattern Recognition Neural Networks, Kernel Methods, Sparse Kernel Machines, Graphical Models, Mixture Models and EM.

UNIT IV: Approximate Inference, Sampling Methods for Pattern Recognition, Continuous Latent Variables.

UNIT V: HYBRID INTELLIGENT SYSTEMS Pattern Recognition in Sequential Data, Combining Models for Pattern Recognition.

TEXT BOOK(S):

1. Pattern and Anomaly Detection (IBM ICE Publications).

STREAM: DATA ANALYTICS

4.7 213CSE1303: INTRODUCTION TO DATA ANALYTICS

213CSE1303	**Introduction to Data Analytics**	**L** 4	**T** 0	**P** 2	**X** 0	**C** 4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Prepare the students to understand and gain the basic knowledge about data analytics and its evolution.
- Gain knowledge about various business intelligence frameworks techniques to handle data analytics information.
- Familiarizes the students with the help of data warehousing and data mining platform concepts to perform data analytic tasks.

COURSE OUTCOMES:

CO1: Understand the fundamentals of business analytics and optimization.

CO2: Understand the basic concepts of data warehouse and functionality of the various data warehousing components and how it differs from traditional data base systems.

CO3: Apply the business intelligence techniques in various project activities.

CO4: Apply various data mining and big data techniques in various business intelligence components.

CO5: Analyze the different dashboard and report design strategies and framework used in data analytics.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			M		M	M				M	S	S	L
CO2	M	M		S								L	S	L
CO3				S	S								S	M
CO4				M		S	S	M		M	M		S	M
CO5	M	M	M	M			S		S				S	S

UNIT I: BUSINESS ANALYTICS AND OPTIMIZATION

Introduction to Business Analytics and Optimization, Challenges - Volume, Variety (Diversity), and speed of Data Creation (and needed decisions), Approaches to help maximize profitability and returns, Business Analytics Capabilities, Enterprise Analytics Capabilities, Business Analytics Technologies, Predictive Analytics, Prescriptive Analytics, A fact-based decision making culture, A strong data infrastructure, The Right Analytical Tools, Analytics Workforce, Knowledge Requirements, Business Analyst, Data Scientist, Where to put the analytics team, IBM Business Analytics Maturity Model, Optimization, Key BAO Concepts, The need for BAO now, Essential Capabilities In BAO, BAO Capabilities: Business Performance Management, Predictive Analysis and Mining, Value of BAO to Business Organization, Impact of BAO on diverse industries, Advantages to implementing BAO solutions, BAO Capabilities: Real-time Analytics: Data In Motion, BAO support for decision-making, , IBM Technology Portfolio for BAO, Analytical Tools, Data Analysis in the real world.

UNIT II: DATA WAREHOUSE

Decision Support, Three-Tier Decision Support Systems, Exploring and Analyzing Data, what is a data warehouse? Data warehouse architecture choices, Enterprise data warehouse, Independent data mart architecture, Dependent data mart architecture, Data Warehouse, Data warehouse usage, Multidimensional Data, Conceptual Modeling of Data Warehouses, The “Classic” Star Schema, The “Snowflake” Schema, The “Fact Constellation” Schema, Data Warehouse Design Process, Single-Layer Architecture, Two-Layer Architecture, Three-Tier Data Warehouse Architecture, Data Warehouse Development, Multi-Tiered Architecture, Information pyramid, BI reporting tool architectures, Types of BI users, Multidimensional analysis techniques, Data Analysis and OLAP, OLAP Server Architectures, Data Cube, Discovery-Driven Data Cubes, OLTP vs. OLAP, Business Query, Dashboards and Scorecards Development, Metadata Model, Automated Tasks and Events, Mobile BI, Disconnected BI, Collaborative BI, Real-time Monitoring, Software Development Kit (SDK), Setting up data for BI, Making BI easy to consume.

UNIT III: BUSINESS INTELLIGENCE

Definitions of Business Intelligence, Sample BI Architecture, Things are getting more complex, BI Components and Architecture, Scope and fit of BI solutions within existing infrastructure, High Level BI Process, Functional Areas of BI Tool, A single or a few applications, Benefits of BI, Maximize Value from BI Systems, Strategy and Business Intelligence, Business Transformation Projects, Business Role of BI (TWDI), ASUG Business Intelligence Maturity Model, Why Act? BI Effectiveness Scorecard, BI Value Scorecard, Five key areas of strategy, Planning a BI Project, Pre-Engagement Activities, Engagement Activities and process, BI Design and Development, Business Environment, Project Tasks: Task 1- Knowledge Capture Goals - Discuss Business Objectives Prior Learning, Interview key stakeholders, Project Planning, Task 2 - Consolidate Findings - Create logical design, Task 3 - Map the Customer Situation - Current Environment, Business/Functional Requirements Sample Diagram, Logical BI Diagram, Task 4 -Methodology Approach, Task 5 - Standards Governance, Task 6 - Sections, Milestones and Tasks, Task 7 – Proof of Concept (POC), Task 8 – Table Creation, Task 9

– OLAP Creation, Task 10 –Final Deliverables, Risk management and mitigation, Cost justification and measuring success.

UNIT IV: DATA MINING BIG DATA ANALYTICS

What is Data Mining, Evolution of Data Mining, Why Data Mining? Knowledge-Based System, Data Mining Process, Phases of Data Mining Process, KDD Process Model, CRISP - DM, CRISP-DM - Elaborate view, Data Mining – On what kinds of Data? DM Tasks and Components of DM methods, Data mining operations, Data mining techniques, Industry examples of application of DM, Challenges of Data Mining, Why Machine should "Learn"? What is Machine Learning? Growth of Machine Learning, Machine Learning types, Unsupervised learning, Reinforcement Learning. Cleaning and Wrangling Data What is Big Data? Intrinsic Property of Data…it grows, A Growing Interconnected and Instrumental World, Need for Big Data, Characteristics of Big Data, Structure of Big Data and need for standards, Big Data Analytics Adoption, Benefits Barrier of Big Data Analytics, Trends for Big Data Analytics, Commoditization of Hardware Enabling New Analytics, the 5 Key Big Data Use Cases, More Ways – Wide Ranging Analytics and Techniques, Big Data Platform and Application Frameworks, A Big Data Platform Manifesto, Use Cases for a Big Data Platform.

UNIT V: DASHBOARD REPORT DESIGNING

Definition, Dashboard Types, Evolution of Dashboards, Layers of Information, Dashboard Design, Dashboard Design Principles, Other Dashboard Examples, Display Media for Dashboards, Chart Overview, Singular Components, Metrics, Metrics drive behavior in a number of ways, Kaplan Norton Balanced Scorecard, The Rayport-Jaworski Performance Dashboard and Strategy Framework, Introducing the R-J Performance Dashboard, Blueprint to the R-J Performance Dashboard, Building Reports, List Report, Crosstab Report, Chart Report, Map Report, Data group, sort and Filters, add calculations to report, Conditions and Aggregations in Report, Drilling in report, Run report – on demand or schedule, Charts, Chart Type – Bar Chart, Line, Pie, Area, Scatter, Data Analytics in different sector, Analytical framework and Latest Trends.

15 WEEK COURSE PLAN

Course Chart	Lecture (2 hours)		Practical (2 hours)	
Weeks	Topic	Pedagogy	Topic	Pedagogy
Week 1	Introduction to Business Analytics and Optimization, Challenges - Volume, Variety (Diversity), and speed of Data Creation (and needed decisions)	Explicit Teaching	Introduction to Statistical Central Tendency Measures using EXCEL	Demonstration

	Approaches to help maximize profitability and returns, Business Analytics Capabilities, Enterprise Analytics Capabilities	Explicit Teaching		
	Business Analytics Technologies, Predictive Analytics, Prescriptive Analytics	Explicit Teaching		
Week 2	A fact-based decision making culture, A strong data infrastructure, The Right Analytical Tools, Analytics Workforce, Knowledge Requirements	Explicit Teaching	Simple Data Visualization using Excel	Demonstration
	Business Analyst, Data Scientist, Where to put the analytics team, IBM Business Analytics Maturity Model	Explicit Teaching		
	Optimization, Key BAO Concepts, The need for BAO now, Essential Capabilities In BAO, BAO Capabilities: Business Performance Management	Explicit Teaching		
Week 3	Predictive Analysis and Mining, Value of BAO to Business Organization, Impact of BAO on diverse industries	Explicit Teaching	Advanced Data Visualization using Excel	Demonstration
	Advantages to implementing BAO solutions, BAO Capabilities: Real-time Analytics: Data In Motion	Explicit Teaching		
	BAO support for decision-making, , IBM Technology Portfolio for BAO	Explicit Teaching		

Week 4	Decision Support, Three-Tier Decision Support Systems, Exploring and Analyzing Data	Problem Solving	Data Visualization using PIVOT Table and Charts	Demonstration
	What is a data warehouse? Data warehouse architecture choices, Enterprise data warehouse	Explicit Teaching		
	Independent data mart architecture, Dependent data mart architecture, Data Warehouse, Data warehouse usage	Explicit Teaching		
Week 5	Multidimensional Data, Conceptual Modeling of Data Warehouses, The "Classic" Star Schema, The "Snowflake" Schema, The "Fact Constellation" Schema	Problem Solving	Advanced Visualization using PIVOT Table and Charts	Demonstration
	Data Warehouse Design Process, Single-Layer Architecture, Two-Layer Architecture, Three-Tier Data Warehouse Architecture, Data Warehouse Development	Explicit Teaching		
	Multi-Tiered Architecture, Information pyramid, BI reporting tool architectures, Types of BI users, Multidimensional analysis techniques	Explicit Teaching		
Week 6	Data Analysis and OLAP, OLAP Server Architectures, Data Cube, Discovery-Driven Data Cubes, OLTP vs. OLAP	Explicit Teaching	Hands-on Session on Pandas, Matplotlib, Numpy	Demonstration

	Business Query, Dashboards and Scorecards Development, Metadata Model, Automated Tasks and Events, Mobile BI, Disconnected BI, Collaborative BI	Explicit Teaching		
	Real-time Monitoring, Software Development Kit (SDK), Setting up data for BI, Making BI easy to consume.	Explicit Teaching		
Week 7	Definitions of Business Intelligence, Sample BI Architecture, Things are getting more complex, BI Components and Architecture	Explicit Teaching	Hands on Session on Sklearn	Demonstration
	Scope and fit of BI solutions within existing infrastructure, High Level BI Process, Functional Areas of BI Tool, A single or a few applications, Benefits of BI, Maximize Value from BI Systems	Explicit Teaching		
	Strategy and Business Intelligence, Business Transformation Projects, Business Role of BI (TWDI)	Explicit Teaching		
Week 8	ASUG Business Intelligence Maturity Model, Why Act? BI Effectiveness Scorecard	Explicit Teaching	Statistical Measures using Python	Demonstration
	BI Value Scorecard, Five key areas of strategy, Planning a BI Project, Pre-Engagement Activities	Explicit Teaching		

	Engagement Activities and process, BI Design and Development, Business Environment	Explicit Teaching		
Week 9	Project Tasks: Task 1- Knowledge Capture Goals - Discuss Business Objectives & Prior Learning, Interview key stakeholders, Project Planning, Task 2 - Consolidate Findings - Create logical design, Task 3 - Map the Customer Situation - Current Environment, Business/Functional Requirements Sample Diagram, Logical BI Diagram	Explicit Teaching	Data Visualization using Python	Demonstration
	Task 4 -Methodology & Approach, Task 5 - Standards & Governance, Task 6 - Sections, Milestones and Tasks, Task 7 – Proof of Concept (POC)	Explicit Teaching		
	Task 8 – Table Creation, Task 9 – OLAP Creation, Task 10 –Final Deliverables, Risk management and mitigation, Cost justification and measuring success	Explicit Teaching		
Week 10	What is Data Mining, Evolution of Data Mining, Why Data Mining? Knowledge-Based System	Explicit Teaching	Data Visualization using Python	Demonstration
	Data Mining Process, Phases of Data Mining Process, KDD Process Model, CRISP - DM, CRISP-DM - Elaborate view	Explicit Teaching		

	Data Mining – On what kinds of Data? DM Tasks and Components of DM methods	Explicit Teaching		
Week 11	Data mining operations, Data mining techniques, Industry examples of application of DM	Explicit Teaching	Data Visualization using Python	Demonstration
	Challenges of Data Mining, Why Machine should "Learn"? What is Machine Learning? Growth of Machine Learning	Explicit Teaching		
	Machine Learning types, Supervised learning, Unsupervised learning, Reinforcement Learning.	Explicit Teaching		
Week 12	What is Big Data? Intrinsic Property of Data…it grows, A Growing Interconnected and Instrumental World, Need for Big Data, Characteristics of Big Data, Structure of Big Data and need for standards	Explicit Teaching	Simple Linear Regression	Demonstration
	Big Data Analytics Adoption, Benefits & Barrier of Big Data Analytics, Trends for Big Data Analytics, Commoditization of Hardware Enabling New Analytics, the 5 Key Big Data Use Cases, More Ways – Wide Ranging Analytics and Techniques	Explicit Teaching		

	Big Data Platform and Application Frameworks, A Big Data Platform Manifesto, Use Cases for a Big Data Platform	Explicit Teaching		
Week 13	Definition, Dashboard Types, Evolution of Dashboards, Layers of Information	Explicit Teaching	Decision Tree Learning	Demonstration
	Dashboard Design, Dashboard Design Principles	Explicit Teaching		
	Other Dashboard Examples, Display Media for Dashboards	Explicit Teaching		
Week 14	Chart Overview, Singular Components, Metrics, Metrics drive behavior in a number of ways	Explicit Teaching	Dashboard design	Demonstration
	KaplanNorton Balanced Scorecard, The Rayport-Jaworski Performance Dashboard and Strategy Framework	Explicit Teaching		
	Introducing the R-J Performance Dashboard, Blueprint to the R-J Performance Dashboard	Explicit Teaching		
Week 15	Building Reports, List Report, Crosstab Report, Chart Report, Map Report	Explicit Teaching	Building a report with online data	Demonstration
	Data group, sort and Filters, add calculations to report, Conditions and Aggregations in Report, Drilling in report	Explicit Teaching		
	Run report – on demand or schedule, Charts, Chart Type – Bar Chart, Line, Pie, Area, Scatter	Explicit Teaching		

EXPERIMENTS:

1. Statistical Central Tendency Measures using Spread Sheet
2. Simple Data Visualization using Spread Sheet
3. Advanced Visualization using Spread Sheet
4. Data Visualization using PIVOT Table and Charts
5. Advanced Visualization using PIVOT Table and Charts
6. Statistical Central Tendency Measures using Python
7. Simple Data Visualization using Python
8. Advanced Data Visualization using Python
9. Building a dashboard report with online data
10. Web Scraping

TEXT BOOK(S):

1. Introduction to Data Analytics (IBM ICE Publications)

REFERENCES:

1. Big Data for Dummies,Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, Wiley Brand, 2013.
2. Analytics in a Big Data World, The Essential Guide to Data Science and its Applications,Bart Baesens, Wiley, First edition,2014.
3. Mining of Massive Datasets, Anand Rajaraman, Jeffrey D. Ullman, Cambridge University Press New York, 2011.
4. Understanding Big Data- Paul C. Zikopoulos, Chris Eaton, McGraw-Hill, 2012 (eBook from IBM)

4.8 213CSE2305: DATA WAREHOUSING & MULTIDIMENSIONAL MODELING

213CSE2305	DATA WAREHOUSING & MULTI-DIMENSIONAL MODELING	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the fundamentals of data warehouse and its applications.
CO2: Design data warehouse with dimensional modelling and to apply the various OLAP operations.
CO3: Analyze the different multidimensional modelling techniques.
CO4: Apply R-OLAP to different design technique and compare the performance.
CO5: Design MOLAP and analyze the various online data analysis with ROLAP.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M			M								S	L
CO2	M	S	S	M	S				L		L	L	S	M
CO3	S	M	S	M	M	L	L				M	M	S	L
CO4	S	M	S	M	M	L	L				M	M	S	M
CO5	M	S	S	M	S				L		L	L	S	M

UNIT I: INTRODUCTION TO DATA WAREHOUSING Data Warehouse Architectures, A perspective on decision support applications.

UNIT II: DATA WAREHOUSING AND MODELING An Introduction to Data Warehouse Modeling, Differentiating the Warehousing model from the OLTP model, Warehouse Modeling Approaches, OLAP – OnLine Analytical Processing, Basic OLAP Operations.

UNIT III: MULTI-DIMENSIONAL MODELING – METHODOLOGY Requirement Analysis, Requirements modeling, Terminologies in a Multi-dimension Model, Multi-Dimensional Model Structures, Solution Validation Techniques, Detailed Dimension Modeling.

UNIT IV: NON-TEMPORAL DESIGN - R-OLAP R-OLAP and its design techniques, Design techniques of an R-OLAP System, Dimension-Oriented Design techniques, Fact-oriented Design Techniques, Utilize Cubing Services to improve R-OLAP and M-OLAP performance, Cubing Services performance and scalability, Scalability, Cubing Services security, Role-based security in Cubing Services.

UNIT V: NON-TEMPORAL DESIGN - M-OLAP IBM Cognos Architecture, Sparse and Dense Dimensions – with Hyperion Essbase, MOLAP characteristics, Online Data Analysis MOLAP and ROLAP.

TEXT BOOK(S):

1. Data Warehouse Multidimensional Modeling (IBM ICE Publications)

REFERENCE BOOK(S):

1. Data Warehousing and Mining :Concepts, Methodologies, Toolls and Applications (Vol I to VI) by John Wang
2. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd Edition by Ralph Kimball and Margy Ross
3. Open Source Data Warehousing and Business Intelligence by Lakshman Bulusu Auerach Pulications
4. Data Mining and Data Warehousing by Bharat Bhushan Agarwal and Sumit Prakash ,Tayal Laxmi Publications.

List of Lab Experiments:

1. Working with Kettle
2. Enhancing Data Integration and Warehouse Design
3. Surrogate Key, Processing a header and trailer text file and Data Allocation
4. Data Allocation Pentaho Data Integration example
5. Introduction to the Case Study - implementation of a data warehouse project for a chain of home entertainment rental stores
6. Business Requirements for Rental and Sales Analysis
7. Business Requirements for Working Shifts
8. Business Requirements for Customers

4.9 213CSE2306: DATA VISUALIZATION FOR ANALYTICS

213CSE2306	**DATA VISUALIZATION FOR ANALYTICS**	**L**	**T**	**P**	**X**	**C**
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the basic concepts of data analytics and visualization.
CO2: Analyze the different types of data analytics and charts.
CO3: Apply the different types of hypothesis testing using ANOVA.
CO4: Create visualization report, graphs and charts using tableau.
CO5: Design the scoreboards and dashboard for data analytics.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S			M								S	L
CO2	S	M	M	L	M	L	L				L	M	S	L
CO3	S	S	S	M	M	L	L				M	L	S	L
CO4	S	S	S	L	M		L		L		L		S	L
CO5	M	S	S	M	S				L		L	L	S	L

UNIT I: Exploratory data analysis and visulaization Importance of data analysis, Descriptive vs predictive vs prescriptive, Overview of commonly used techniques, Univariate analysis, Distributions, Outlier detection, Histograms, box plots, Bar charts, Classification, Association and Segmentation models using SPSS.

UNIT II: Exploratory Data Analytics and Charts T-Test, Bi-variate Analysis, Correlations, Crosstabs, Heatmaps, Stacked bars, Line charts, Multi-variate Analysis, Trending analysis, Geographical analysis, Maps, Scatter plot, Muli line charts, Area graph, Labs using R/Python/SPSS.

UNIT III: Hypothesis Testing Hypothesis Testing, T-test, Chi-square test, ANNOVA, Clustering Analysis, Cognitive Analytics, create reports based on relationships, Labs using SPSS/R/Python.

UNIT IV: Visualizing Business Intelligence Representing data using graphs and charts- Line chart, Bar, Box plot, Scatter chart, Building visualization reports using tableau

UNIT V: Dashboard and Scorecards Scorecards and Dashboard creation for data analytics, Dynamic reporting, Enhance user interaction.

TEXT BOOK(S):

1. Data Visualization for Analytics (IBM ICE Publications).

4.10 213CSE3305: DESCRIPTIVE ANALYTICS

213CSE3305	**DESCRIPTIVE ANALYTICS**	**L** 4	**T** 0	**P** 2	**X** 0	**C** 4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the concepts of Business Intelligence(BI), BI Tools and BI Systems.
CO2: Evaluate the Business Intelligence(BI) Solutions based on Software Development Kit.
CO3: Create a Business Intelligence projects and Analyze the Business Intelligence Solutions.
CO4: Create a report for Business Intelligence Projects by using the operations of Intelligence Techniques.
CO5: Evaluate the Business Intelligence(BI) Projects using projects estimation models.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S	S	S				L		M	S	S	L
CO2	S	S	S	S	S			S		M	M	S	S	M
CO3	S	S	S	S	S		S				M	S	S	S
CO4	S	S	S	S	S	S					M	S	S	M
CO5	S	S	S	S	S						M	S	S	S

UNIT I: Introduction to Business Intelligence Business Intelligence (BI), Scope of BI solutions and their fitting into existing infrastructure, BI Components and architecture, BI Components, Future of Business Intelligence, SaaS and Cloud computing techniques, Functional areas of BI tools, End user assumptions, Setting up data for BI, Data warehouse, OLAP and advanced analytics, Supporting the requirements of senior executives including performance management, Glossary of terms and their definitions specific to the field of BI and BI systems.

UNIT II: Elements of Business Intelligence Solutions Business Query and Reporting, Reporting, Dashboards and Scorecards Development, Development, Scorecards, Metadata models, Automated Tasks and Events, Mobile Business Intelligence, Software development kit (SDK).

UNIT III: Building BI Project Stages of Business Intelligence Projects, Project Tasks, Risk Management and Mitigation, Cost justifying BI solutions and measuring success, BI Design and Development.

UNIT IV: Report Authoring Building Reports, Building a Report, Drill-up, Drill-down Capabilities.

UNIT V:BI Deployment, Administration and Security Centralized versus Decentralized Architecture, Phased and Incremental BI road map, Setting early expectations and measuring the results, EPM (Enterprise performance Management), End-User Provisos, OLAP Implementation, Implementation, Data Warehouse Architecture, Predictive Analysis, Text Mining , Authentication, Authorization, Access Permissions, Group and Roles, Single Sign-on (SSO), Data Backup and Restoring.

TEXT BOOK(S):

1. Descriptive Analytics (IBM ICE Publications).

1. Rajiv Sabherwal and Irma Becerra-Fernandez, Business Intelligence, Wiley Publications (2010)
2. Swain Scheps, Business Intelligence For Dummies, Wiley Publications (2011)
3. Arshad Khan, Business Intelligence Data Warehousing Simplified, Mercury learning information LLC (2012)

4.11 213CSE3306: BIG DATA ANALYTICS

213CSE3306	Big Data Analytics	L	T	P	X	C
		4	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Prepare the students to understand and gain the basic knowledge about big data and its evolution.
- Gain knowledge about various frameworks techniques to handle big data like Hive,and Hadoop Distributed file systems, Hbase, Impala and so on.
- Familiarizes the students with Sqoop and Pig for R programming concepts to perform data analytic tasks.

COURSE OUTCOMES:

CO1: Understand the key issues on big data, characteristics, data sources and the associated applications in intelligent business and scientific computing.

CO2: Understand the frameworks of Hadoop and Map reduce and apply them to solve complex problems.

CO3: Understand and apply the various Query Language for Hadoop to perform data analytics.

CO4: Apply various Pig: Hadoop Reporting and Analysis tools to perform data analytics operations.

CO5: Apply various Sqoop and R: Hadoop Reporting and Analysis tools to perform data analytics operations.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			M		M	M				M		S	L
CO2	M	M		S								L	S	M
CO3				S	S								S	M
CO4				M		S	S	M		M	M		S	M
CO5	M	M	M	M			S		L				S	S

UNIT I: INTRODUCTION to BIG DATA ANALYTICS

Big Data overview, Structures of data, Big Data growth story, Big Data sources, Big Data adoption drivers, Need of Big Data, Growth drivers for IT industry, Big Data: Definition, Characteristics of Big Data, Units to measure Big Data, Big Data types, Benefits barrier of Big Data analytics, Need of Big Data, Big Data process, Big Data framework, Big Data platform and application frameworks, An example of Big Data platform in practice, A Big Data platform manifesto, Big Data technologies, Big Data tools, Big Data analytics, Merging the traditional and Big Data approaches, More ways: Wide ranging analytics and techniques, The 5 key Big Data use cases, Big Data usage, Use cases, Big Data and complexity in health care, Use cases: Healthcare and life sciences, Use cases: Transportation services, Use cases: Life insurance, IBM's Big Data success story, Data repository analyst view, Business drivers with examples, BI versus data studies, Architecture of modern analytics, Large data drivers, Method to study the evolving Big Data environment, Latest Big Data ecosystem, Large data research explanations, Overview of lifecycle data processing, Major functions for a good research, Information analytics history and summary, Big Data resources, Tackling the question, Primary stakeholders recognition, Analytical supporter interview, Original assumptions creation, Potential databases detection, Preparing evidence for Big Databases, Analytical sandbox planning, ETL execution, The data learning, Data conditioning, Visualize and verification, Popular data preparation instruments, Step 3: Planning of models, Research on model planning in industry verticals, Data exploration, Big Data: Choice of model, Popular model of Big Data, Step 4: Model design, Popular model building tools, Step 5: Results contact, Step 6: Consumption, Key outputs from a successful analytics project, Case study: Digital network for creativity and research (GINA), Step 1: Searching, Step 2: Preparing evidence, Step 3: Planning of models, Step 4: Model design, Step 5: Results contact, Step 6: Consumption.

UNIT II: HADOOP FUNDAMENTALS

What is Hadoop? Examples of Hadoop in action: IBM Watson, Examples of Hadoop in action, Introduction to Hadoop, Data distribution, Flat scalability, HDFS (Hadoop Distributed File System), Name nodes, Data nodes, Data nodes with blocks of multiple files with a replica of 2, The data is distributed across nodes at the time of loading, MapReduce, An SQL example of MapReduce, The map function, Sort phase, The reduce function, Combiner and partition functions, Streaming and pipes, MapReduce example: Wordcount, MapReduce co-locating with HDFS, MapReduce processing, Speculative execution, MapReduce: A tale of two APIs, MapReduce anatomy, What is HBase? NoSQL technology, CAP theorem, ACID properties, Why HBase? Important things to keep in mind, HBase vs. RDBMS, For example, Physical view in HBase, Logical to physical view, HBase components, HBase components definitions and roles, Characteristics of HBase tables, HBase is a sorted multidimensional map, Row key design considerations, Column family design considerations, Cluster configuration, HDFS configurations settings, Hadoop site.xml for a single-node configuration, HDFS start, Interact with HDFS, Example of put command, Retrieve data from HDFS, HDFS command reference, HDFS permissions and security, HDFS additional tasks: Rebalancing blocks, Closing the nodes, Check health file system, Load scenarios, Load solution using Flume, How Flume works, Consolidation, Replicating and multiplexing, Apache Hadoop core components, Why Hadoop Apache? Why is it easier for Hadoop than other distributed computing systems? Where is Hadoop ideal for computing? Daemons of HDFS, Secondary name node, Check-pointing by secondary name node, HDFS architecture, Daemons MapReduce, YARN capital assignments, Node manager with three containers, Resource allocation on another node, Running tasks on m multiple containers, Resource allocation, Fair scheduler per-queue properties, The map reducing job workflow, HDFS daemons with strong disponibility, Height of the block, A file stored in a single block, Abstract block, Name node keeps the block locations, Data flow in replication, Data pipeline in creating block replicas, Under reproduction, Name node metadata, Single namespace HDFS architecture, HDFS federation architecture, Place of data, Replica placement on two racks, HDFS network topology, Table: Block location class methods, How does HDFS store, read, and write files? Data node pipeline in writing a file, Verification of checksum, Data collection and data analysis Hadoop cluster, Hadoop cluster in data storage and processing, Master protocol application, MRv2 cluster operation, Current and existing APIs, Data serialization options, Apache Avro, Sequence and Avro reference files, Apache Thrift, Thrift and protocol buffers comparison, Commands for HDFS shell file system, Select MapReduce work main and importance forms, A mapper's development cycle and areducer's function, The mapper's life cycle in the latest API, A reducer's life-cycle in the old API, The reducer lifecycle in the latest API, Input clues to output clues link, Input/Output Mapper sort, Key/Value types, Input Formats in the old API, Mapper Key/Values Input/Output number, Reducer Input/Output number of K values, Keys and attributes sorting, Combiners, Shuffle, Table: Parameters in compare methods, Table: Configuration properties to tune the sort and shuffle process, MapReduce with shuffle and sort, Settings and submissions for MapReduce job, Table: FileInputFormat¡K,V¿ class Static methods using JobConf, Settings and submissions for MapReduce job, Combiner on reducer, Shuffle transfer number, Speculative performance, Data paths in MapReduce task input and output, Data movement in a MapReduce job in the reduce phase, Data flow provided by the InputFormat, Data flow provided by the OutputFormat, InputFormats for File-Based Input formats, Table: InputFormats for File-Based Input formats, RecordReader, compression andsequence files, LineRecordReader example, RecordReader with FileSplit, Built-In RecordReaders, Sequence files, SequenceFileInputFormat classsubclasses, SequenceFile class nested classes and interfaces, Sequence file header, Compression, Configuration properties for configuring, Codecs supported by Hadoop, Commands for HDFS Shell file system, Administration commands.

UNIT III: QUERY LANGUAGES FOR HADOOP

What is JAQL? JSON: JavaScript Object Notation, JSON format, where does JAQL fit? MapReduce overview, MapReduce and Hadoop, Starting up the JAQL server entering JAQL in command line mode, JAQL and MapReduce, Let's do this step by step, JAQL and MapReduce: The rewrite engine and explain, JAQL schema, Data types, JAQL basics, Arrays, Records, Operators, Lazy/late evaluation, Why materialized assignment (:=) ? The -¿ operator, Expressions, Functions, Why JAQL core operators, Core operators: Expand, Core operators: Group, Core operators: Group format (single), Core operators: Group (single), Core operators: Understanding grouping, Core operators: Cogroups, Core operators: Join outer joins, Core operators: Sort, JAQL SQL, JAQL SQL: Case-sensitivity, JAQL and MapReduce basics, JAQL and MapReduce: Explain, JAQL and MapReduce: Map, MapReduce: Job configuration, JAQL and MapReduce: Native MR jobs, JAQL I/O, JAQL I/O adapter operations, JAQL I/O: I/O adapters, JAQL

I/O: I/O adapters arguments, JAQL I/O: Delimited files, JAQL I/O: Binary sequence files, JAQL I/O: Text sequence files, JAQL I/O: Other adapters.

UNIT IV: PIG: HADOOP REPORTING AND ANALYSIS

What is Pig? Pig versus other tools, Executing Pig, First look at Pig data, Pig Latin statement basics, Input, LOAD operator continued, Accessing data, Case sensitivity, Field reference, Pig data types, Operators, Parameter substitution, Output, MapReduce in Pig, Cascading in Pig, Apache hive and Pig, Pig data form, Complex data types, Map, Schema, Casting, Casting error, Comparison operators, Identifiers, Boolean operators, Invoking the grunt shell, Auto completion, Grunt shell flow, Pig operators and commands, Regex in the file path, Store, Dump, Foreach generate, Flatten, New schema, Nested block, Null, Comparison operators, Assert, SPLIT, Flatten, RANK, Order by, Using the partitioner, Using a shell program, MapReduce program, CUBE, Rollup, Parameter substitution, Advanced JOIN, Equi Joins, Inner Joins, Left outer join, Cogroup, CROSS Join, Functions, Pig storage, HBase Storage, Apache Oozie, Types of Oozie jobs, Set a value to a property, Scheduling a Pig script, Integrating with the workflow, Upload Files to HDFS, Bundle, Oozie user interface.

UNIT V: SQOOP AND R: HADOOP REPORTING AND ANALYSIS

What is Sqoop? Sqoop connection, Sqoop import, Sqoop import examples, Sqoop exports, Sqoop exports, Additional export information, Distributed systems, Sqoop command. What is open-source R? The R appeal: What attracts users? Companies currently using R, what is the R programming language? Limitations of open-source R, Open source R packages to boost performance, Challenges with running large-scale analytics, 3 key capabilities in big R, Big R architecture, User experience for big R, what's behind running big r's scalable algorithms? Big R machine learning: Scalability and performance, Simple Big R example.

15 WEEK COURSE PLAN

Course Chart Weeks	Lecture (2 hours)		Practical (2 hours)	
	Topic	Pedagogy	Topic	Pedagogy
Week 1	Big Data overview, Structures of data, Big Data growth story, Big Data sources	Explicit teaching	HDFS Basic commands	Demonstration

	Big Data process, Big Data framework, Big Data platform and application frameworks, An example of Big Data platform in practice	Explicit teaching	HDFS Basic command	Demonstration
	Big Data resources, Tackling the question, Primary stakeholders recognition, Analytical supporter interview, Original assumptions creation, Potential databases detection, Preparing evidence for Big Databases	Explicit teaching	HDFS advanced comands	Demonstration
Week 2	The data learning, Data conditioning, Visualize and verification, Popular data preparation instruments	drill and practice	HDFS advanced comands	Demonstration
	Step 1: Searching, Step 2: Preparing evidence, Step 3: Planning of models, Step 4: Model design, Step 5: Results contact, Step 6: Consumption.	Explicit teaching	HDFC commands to handle unstructured datasets, HDFC commands to handle Semi-unstructured datasets (XML files)	Demonstration
	Hadoop in action: IBM Watson, Examples of Hadoop in action, Introduction to Hadoop, Data distribution, Flat scalability, HDFS (Hadoop Distributed File System)	Explicit teaching		Demonstration

Week 3	MapReduce, An SQL example of MapReduce, The map function, Sort phase, The reduce function, Combiner and partition functions	Explicit teaching	MapReduce Program – Word count, MapReduce Program – Find the maximum temperature of city	Problem based learning
	MapReduce example: Wordcount, MapReduce co-locating with HDFS, MapReduce processing, Speculative execution, MapReduce: A tale of two APIs, MapReduce anatomy.	Explicit teaching		
	HDFS configurations settings, Hadoop site.xml for a single-node configuration, HDFS start, Interact with HDFS, Example of put command, Retrieve data from HDFS, HDFS command reference, HDFS permissions and security, HDFS additional tasks	Explicit teaching	"MapReduce Program – Weather Data Analysis	
Week 4	Daemons of HDFS, Secondary name node, Check-pointing by secondary name node, HDFS architecture, Daemons MapReduce, YARN capital assignments	Explicit teaching		Problem based learning
	Resource allocation, Fair scheduler per-queue properties, The map reducing job workflow, HDFS daemons with strong disponibility, Height of the block	drill and practice	MapReduce Program – Aggregating text fields	

Week 5	Single namespace HDFS architecture, HDFS federation architecture, Place of data, Replica placement on two racks, HDFS network topology	Explicit teaching		Demonstration
	MapReduce with shuffle and sort, Settings and submissions for MapReduce job	drill and practice		
Week 6	Data movement in a MapReduce job in the reduce phase, Data flow provided by the InputFormat, Data flow provided by the OutputFormat, InputFormats for File-Based Input formats	Explicit teaching	"Hive commands Hive Joins for Datasets"	Problem based learning
	JSON: JavaScript Object Notation, JSON format, where does JAQL fit,Starting up the JAQL server & entering JAQL in command line mode			
Week 7	JAQL and MapReduce, Let's do this step by step, JAQL and MapReduce: The rewrite engine and explain, JAQL schema, Data types, JAQL basics, Arrays, Records, Operators, Lazy/late evaluation	Explicit teaching	" Hive Partitioning for Datasets Hive Bucketing "	Problem based learning
Week 8	Core operators: Co-groups, Core operators: Join outer joins, Core operators: Sort, JAQL SQL, JAQL SQL			

	I/O adapters, JAQL I/O: I/O adapters arguments, JAQL I/O: Delimited files, JAQL I/O: Binary sequence files, JAQL I/O: Text sequence files, JAQL I/O: Other adapters.	drill and practice	"Hive Performance tuning Hive MapReduce"	Problem based learning
Week 9	JSON: JavaScript Object Notation, JSON format, where does JAQL fit Starting up the JAQL server & entering JAQL in command line mode	Explicit teaching	PIG commands	
	Sort, JAQL SQL, JAQL SQL: Case-sensitivity, JAQL and MapReduce basics, JAQL and MapReduce	Explicit teaching	PIG - Group By, Nested Foreach, Join	
Week 10	Pig: Hadoop Reporting and Analysis What is Pig? Pig versus other tools, Executing Pig,	drill and practice	PIG MapReduce - word count	Demonstration
Week 11	MapReduce in Pig, Cascading in Pig, Apache hive and Pig	drill and practice	"Hive commands Hive Joins for Datasets Hive Partitioning for Datasets"	
	First look at Pig data, Pig Latin statement basics	Explicit teaching	"Hive Performance tuning Hive MapReducePIG MapReduce - word count "	
Week 12	Pig operators and commands, Regex in the file path, Store, Dump, Foreach generate	drill and practice	PIG - Twitter Data analysis	Demonstration
Week 13	Sqoop connection, Sqoop import, Sqoop import examples, Sqoop exports	Explicit teaching	SQOOP Operations	Demonstration

	R programming language? Limitations of open-source R, Open source R packages to boost performanc	Explicit teaching	"Flume - Sentimental analysis Apache Storm - Mobile Call Log Analyzer"	
Week 14	Big R architecture, User experience for big R, what's behind running big r's scalable algorithms	Explicit teaching		
Week 15	Big R machine learning: Scalability and performance, Simple Big R example.	drill and practice	MongoDB Operations	Problem based learning

EXPERIMENTS:

1. HDFS commands – Basic
2. HDFS commands – Advance
3. HDFC commands to handle unstructured datasets
4. HDFC commands to handle Semi- unstructured datasets (XML files)
5. MapReduce Program – Word count
6. MapReduce Program – Find the maximum temperature of city
7. MapReduce Program – Weather Data Analysis
8. MapReduce Program – Aggregating text fields
9. Hive commands
10. Hive Joins for Datasets
11. Hive Partitioning for Datasets
12. Hive Bucketing
13. Hive Performance tuning
14. Hive MapReduce
15. PIG commands
16. PIG - Group By, Nested Foreach, Join
17. PIG MapReduce - word count

18. PIG - Twitter Data analysis
19. SQOOP Operations
20. Flume - Sentimental analysis
21. Apache Storm - Mobile Call Log Analyzer
22. MongoDB Operations

TEXT BOOK(S):

1. Introduction to Data Analytics (IBM ICE Publications)

REFERENCES:

1. Big Data for Dummies,Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, Wiley Brand, 2013.
2. Analytics in a Big Data World, The Essential Guide to Data Science and its Applications,Bart Baesens, Wiley, First edition,2014.
3. Mining of Massive Datasets, Anand Rajaraman, Jeffrey D. Ullman, Cambridge University Press New York, 2011.
4. Understanding Big Data- Paul C. Zikopoulos, Chris Eaton, McGraw-Hill, 2012 (eBook from IBM)

4.12 213CSE4305: SOCIAL, WEB AND MOBILE ANALYTICS

213CSE4305	SOCIAL, WEB AND MOBILE ANALYTICS	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the basic knowledge about web and social analytics.
CO2: Evaluate the KPI metrics using soical media analytics.
CO3: Analyze the mobile analytics and social media analytics.
CO4: Create Social, web,mobile applications based on customer experience management and content publisher operators.
CO5: Understand and analyze the various functionalities in social,web and mobile analytics.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M			M								S	L
CO2	S	M	S		M	L	L				M	L	S	M
CO3	S			M		L	L				M	L	S	M
CO4	S	S		L	M		L		L	L	L			S
CO5	S	M			M								S	S

UNIT I: Introduction to Web Social Analytics and Relevant Data its collection Overview of web social media. Need of using analytics, Web analytics technical requirements. Social media environment, Impact of social media on business, How to leverage social media for better services, current analytics platforms, OpenSource vs licensed platform, choosing right specifications optimal solution. Participating with people centric approach, organizing for social media, Choosing focused Data sources Social networks, collecting and understanding social media data, leverage qualitative data by understanding what, why and how much, usability alternatives, web enabled emerging user research, online surveys.

UNIT II: KPIs/ metrics and Manage Web Social media with Analytics Understand the discipline of social analytics, Aligning social objectives with business goals, Identify common social business objectives, developing KPIs; Standard vs Critical metrics. Bounce rate, exit rate, conversion rate, engagement, strategically aligned KPIs, Tactics to find out best web and social media metrics; moving from strategy to execution, build scorecards dashboards to track KPIs. Measuring Macro micro conversions, Quantify Economic value, measuring success for non-ecommerce and B2B websites, Explore evaluate - Dashboard, Relationships, Sentiments, Evolving Topics, Reports, Content creation tracking, Competitive Intelligence analysis, website traffic analysis, search keyword analysis, audience identification segment analysis, Optimizing social media strategy, Social media enablement audit, Understand signals and potential

UNIT III: Future of Social Media Analytics, Monitoring and Introduction to Mobile Analytics Mashing Up Data from Disparate Sources; Integrate solution to share outcome with others, Overview, Web Analytics Vs Mobile Analytics, Social media Analytics Vs Mobile analytics, Need of mobile analytics, Basics of mobile computing – Smart phones, mobile browsers, Mobile applications, Bandwidth, transactions, sessions, handset types operating systems, mobile operators their services, WAP gateway or GGSN support, APNs or regional POPs support, Architecture components, mobile webservices, overview of mobile cloud

UNIT IV:Mobile Customer Experience Management, Mobile Analytics for Content Publishers Operators Mobile as next customer experience frontier, Customers expectations, business impact criticality, Core metrics for deeper behavior analysis, Integration of different channels – SMS, Instant messaging, chatting, apps, HTML5 enabled sites on browsers for unique experience, Multi-chennal campaning optimization, considerations for best mobile services, Location based media support, Mobile Handset Analysis, Mobile Handset Screen Resolution - supported screen resolutions of mobile handsets browsing site in terms of page views, visits and visitors, Mobile Operator Analysis - operator names and countries of subscribers browsing your site in terms of page views, visits and visitors. The types of statistics reports –Bandwidth (total, average per visit, total per file type), Transactions (average per visit, number of downloads, page view breakdown), Sessions (entry page, average duration, click paths, referring search engine), Subscribers (browser type, user agent, operating system), Operating system (iOS, Android, Blackberry, etc), Mobile applications (YouTube, Facebook, Twitter, etc), Content categorisation (Adult, Video, Social, Ad Networks, etc), Handsets (make, model, screen resolution), Mobile Operator (country of origin, operator name), Geo Location (Visitor location tracking, country of origin, RDNS lookup), Referrer tracking, Search term performance, Specific visitor behaviour, Page views per visit by referrer/advert, Time spent on site by referrer/advert.

UNIT V: Email marketing and Data Functionalities Logs users email address, Cold callers report, Page views per annum, Data recording timeframe, Data archiving timeframe, Historic comparison, Integration to client platforms through API, HTTPS Support.

TEXT BOOK(S):

1. Social, Web and Mobile Analytics (IBM ICE Publications).

STREAM: CYBER SECURITY AND FORENSICS

4.13 213CSE1302: INFORMATION SECURITY FUNDAMENTALS

213CSE1302	INFORMATION SECURITY FUNDAMENTALS	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- Understand basic concepts of Information Security.
- Learn about various domains under information security
- Enumerate various tools and techniques associated to information security
- Clarify its advantages and disadvantages

COURSE OUTCOMES:

CO1: Understand overview of information security, concepts, benefits, issues and methodology of cost-benefit analysis

CO2: Apply techniques and controls associated to cryptography and operations security

CO3: Recognize the scope of physical and network security, identify the threats, vulnerabilities and categorizise the tools and techniques used for implementation.

CO4: Interpret the need and improtance of Operating System hardening, protection mechanisms and associated vulnerabilities.

CO5: Enumerate concepts of security audit, standards, governance, risk and compliance.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S										S	L
CO2	S	S	S										S	M
CO3	S	S	S	S	S		S				S	S	S	M
CO4	S	S	S										S	L
CO5	S	S	S	S	S		S				S	S	S	L

UNIT I CIA TRIAD

Confidentiality, Integrity Availability, what is Information Security? Identification and Authentication, Authorization and Access Control, Auditing and Accountability.

UNIT II CRYPTOGRAPHY AND OPERATIONS SECURITY

Modern Cryptography Tools, Protecting Data at rest, In motion, and in Use, Origins of Operations Security, The Operations Security Process, Laws of Operations Security, Operations Security in our Personal Lives.

UNIT III PHYSICAL SECURITY AND NETWORK SECURITY

Introduction, Physical Security Controls, Protecting People, Data and Equipment. Protecting Networks, Protecting Network Traffic. Network Security Tools.

UNIT IV OPERATING SYSTEM AND APPLICATION SECURITY

Operating System Hardening, Protecting Against Malware, Software Firewalls and Host Intrusion Detection, Operating System Security Tools, Software Development Vulnerabilities, Web Security, Database Security, Application Security Tools.

INFORMATION SECURITY -AUDIT AND MONITORING, INTELLIGENCE, COMPLIANCE, MANAGEMENT AND GOVERNANCE

Change and Security Implications, System Models, Targets and Methods, Log Management, Data Aggregation and Reduction, Notifications and Reporting, Monitoring and Control Challenges, Auditing Standards, SAS 70 Audits, Sarbanes-Oxley, Addressing Multiple Regulations for Information Security Technical Frameworks for IT Audits, Intelligence and Compliance, Management and Governance.

TEXT BOOK(S):

1. Information Security Fundamentals (IBM ICE Publications)

4.14 213CSE2309: IT PHYSICAL SECURITY AND SYSTEM SECURITY

213CSE2309	IT PHYSICAL SECURITY AND SYSTEM SECURITY	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the physical security and vulnerability assessment.
- To understand the different strategies for security surveys and audit.
- To understand the various approaches to the physical security and Intrusion Detection System (IDS).
- To understand the video technology, bio metric characteristics, control standards and fence standards.
- To understand the fire safety and standards and guidelines for global resources and security personnel.

COURSE OUTCOMES:

CO1: Understand the importance of physical security, to relate between physical and cyber security and perform vulnerability assessment.

CO2: Deep understanding of Physical Security layers, to know what plans and tools are required for a particular environment, and perform survey and audit.

CO3: Understand the approaches to physical security, alarm and intrusion detection system (IDS).

CO4: Enumerate methods employed to mitigate video technology, bio metrics, access control and fence standards for ensuring the physical security.

CO5: Understand the meaning of fire safety inspection, to use the standards, regulations, guidelines and compliance of security personnel to give the solution for future risks.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S										S	L
CO2	S	S	S										S	M
CO3	S	S	S	S	S		S				S	S	S	M
CO4	S	S	S										S	L
CO5	S	S	S	S	S		S				M	M	S	L

UNIT I: PHYSICAL SECURITY OVERVIEW AND VULNERABILITY ASSESSMENT

Importance of Physical Security, Relationship Between Physical and Cyber Security, Guard Against Disgruntled Employees and Angry Former Employees, How Activists and Corporate Foes Can Hurt You, Vandals Who Damage for Fun, Saboteurs Who Work for Profit, Thieves and Spies Are Everywhere, Domestic Terrorists Are Still a Threat, International Terrorist Are a Growing Threat, Physical Security for Natural Disasters, Security for Random Incidents, Steps to Improve Physical IT Security, Influence of Physical Design - Defensible Space, Crime Prevention Through Environmental Design, Risk Management and the Vulnerability Assessment, Risk Assessment and the Vulnerability Assessment Process, Statistics and Quantitative Analysis, Vulnerability Process Overview, Reporting and Using of Vulnerability Assessment, System Engineering and Vulnerability Assessment.

UNIT II: SECURITY SURVEYS AND THE AUDIT

Overview, The best time to conduct the survey, Why conduct a security review, classification of survey recommendations, developing security points, nine points of security concern, personality of the complex, positive and negative aspects of making recommendations, crime analysis, key control, digital closed-circuit television, intrusion alarms, lighting and security, other security aspects, security survey follow-up, residential security, home security checklist, top ten security threats, the audit. Site survey and risk assessment, physical security survey - exterior physical characteristics: perimeter grounds, plant security checklist , security officers checklist , office security checklist , home security checklist - exterior, doors, windows, general home security, miscellaneous, bullet-resistant glazing for a secure workplace, bullet-resistant fiber glass wall panels, bullet-resistant doors, bullet-resistant windows, window film.

UNIT III: APPROACHES TO PHYSICAL SECURITY, SECURITY LIGHTING, ALARMS INTRUSION DETECTION SYSTEMS

Overview, levels of physical security, the value of planning, physical barriers, the security plan. Protective physical barriers - perimeter entrances, barrier planning, combination locks, lock bodies, door lock types, strikes, attacks and countermeasures, locks and the systems approach to security , safes, vaults, and accessories - choose the right container, ul-rated combination locks, relocking devices, locking dials, lockable handles, time locks, time-delay combination locks, alarmed combination locks, vision-restricting and shielded dials, combination changing, safe burglaries, hidden combinations, overcoming safe-opening problems , rating files, safes, and vaults. Illumination, types of lamps, things needed to know about lighting, energy management, lighting definitions, lighting description, components of alarm systems, application, alarm equipment overhaul, a smoke detectors, alarm certificate services - definitions, standards, fire classifications, use of fire extinguishers, Vulnerability Assessment scanning tools: Nikto, Netsparker, W3AF, Nmap, Nessus. .

UNIT IV: VIDEO TECHNOLOGY OVERVIEW, BIOMETRICS CHARACTERISTICS, ACCESS CONTROL AND BADGES, CRYPTOGRAPHY

Video system, camera function, scene illumination, scene characteristics, lenses, cameras, transmission, switchers, quads and multiplexers, monitors, recorders, hard-copy video printers, ancillary equipment, CCTV biometrics characteristics access control, designated restricted areas, degree of security, considerations, employee screening, identification system, id methods, mechanized/automated systems, card/badge specifications, visitor identification and control, visitors, enforcement measures, sign/countersign and code word, duress code, access control rosters, control methods, security controls of packages, personal property, typical design example, Basics of Cryptographic concepts, Symmetric and Asymmetric Cryptography, Hashing algorithms.

UNIT V: FIRE AND FIRE SAFETY INSPECTION, STANDARDS, REGULATIONS, AND GUIDELINES, COMPLIANCE AND YOUR SECURITY PROGRAM

How fire spreads? Four ways to put out a fire, classifying fire, ul standard 217, water supply for sprinklers and tanks. Fire safety inspection - administrative and planning phase, general physical inspection phase, extinguisher inspection phase, stand pipe, fire hose, and control valve inspection phase, sprinkler system inspection phase, hazardous materials inspection phase, alarm system inspection phase. Introduction, standards, regulations, guidelines, managing compliance, resources, Number and function of guards, uniform, firearms, vehicles, guardhouses, communication, rounds, logbooks, hazard assessment, command structure, emergency drills crisis management. Including Global Resources Security personnel - Introduction - Network security, Hardware/Downloadable devices/Data storage, Physical security. Information Technology (IT) Security - Software updates to reduce vulnerabilities, Firewall Account Management - Authentication, One Time passwords. Host security and Host security (System threats and Denial of Service attack) - System Threats - Antivirus software, Worms, Trojan horse, Root kits, Port Scanning, Denial of service attack, Distributed Denial of Service attack

EXPERIMENTS:

1. Installation steps of micro soft baseline security analyzer
2. How to scan a computer by name
3. How to scan a computer by ip address
4. How to scan multiple computers by ip address
5. How to scan multiple computers by domain
6. How to view existing security scan reports
7. Installation steps of tripwire
8. How to start the secure check scanning

9. About the tool window
10. Securecheq summary report
11. How system aspects covered in scan
12. Securecheq test report

TEXT BOOK(S):

1. IT System Security Physical Security (IBM ICE Publications).

4.15 213CSE3309: IT APPLICATION SECURITY

213CSE3309	IT APPLICATION SECURITY	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the software development methodology and application security.
- To design the input validation strategies and protect sensitive data.
- To develop the effective strategies of authentication and authorization.
- To design an application's configuration management features and user session.
- To develop the cryptography, parameter manipulation prevention, exception management and audit, logging considerations.

COURSE OUTCOMES:

CO1: Understand the software development and applications with the help of programming and secure software principles.

CO2: Develop the solutions for input validation and sensitive data for the different applications.

CO3: Understand the various approaches for the authentication and authorization process of the application security.

CO4: Understand the different features of configuration and session management.

CO5: Understand the various approaches for cryptography, parameter manipulation and exception management.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S	S									S	M
CO2	S	S	S	S	S								S	M
CO3	S	S	S	S	S		S		S		S	S	S	M
CO4	S	S	S	S									S	M
CO5	S	S	S	S	S		S		S		M	M	S	S

UNIT I: INTRODUCTION TO SOFTWARE DEVELOPMENT APPLICATION SECURITY

Introduction to software development application, Basics of programming languages, Compiled versus interpreted, Program utilities, Programming concepts, Distributed programming, Threats and malware, Importance of software development life cycle, Software development methods, Adherence to secure software development principles, Web application security principles, Application design development security, Environment and controls, Essence of secure software development, Auditing and assurance mechanisms.

UNIT II: INTRODUCTION TO INPUT VALIDATION SENSITIVE DATA

Introduction to input validation sensitive data, Implementation of input validation, Practical solutions Input validation vulnerability, Buffer overflow, Cross-site scripting, SQL injection, Canonicalization, Sensitive data, Sensitive data access, Sensitive data in storage, Information disclosure, Data tampering, Installation of OWASP BWA application, Need for OWASP BWA, Burp Suite, Wire Shark.

UNIT III: INTRODUCTION TO AUTHENTICATION AUTHORIZATION

Introduction to authentication authorization, Network eavesdropping, Brute force attack, Dictionary attack, Cookie replay attack, Credential theft, Elevation of privilege, Basics of authorization, Data tampering, Luring attack, Phishing attack, File inclusion vulnerability, Remote file inclusion and Cross site request forgery.

UNIT IV: INTRODUCTION TO CONFIGURATION MANAGEMENT SESSION MANAGEMENT

Introduction to configuration management session management, Unauthorized access to administration interfaces, Unauthorized access to configuration stores, Retrieval of clear text configuration data, Lack of individual accountability, Over-privileged process and service accounts, Basics of Session Management, Hijacking attack, Session replay attack, Man in the middle attack.

UNIT V: INTRODUCTION TO CRYPTOGRAPHY, PARAMETER MANIPULATION EXCEPTION MANAGEMENT

Introduction, Poor Key Generation or Key Management, Weak or Custom Encryption, Basics of Parameter Manipulation, Cookie Manipulation, HTTP Header Manipulation, Basics of Exception Management, Denial of Service. Auditing Logging, Countermeasures - Introduction to Auditing Logging, Countermeasures, Basic Countermeasures.

EXPERIMENTS:

1. Scanning the target

2. NMAP
3. Metasploit framework
4. Wire shark
5. HTTP basics
6. Burp Suite
7. OWASP installation
8. Cross site Scripting
9. HTML injection
10. Login Page SQL injection
11. File inclusion vulnerability
12. RFI Remote file inclusion
13. Path traversal attack or Directory browsing attack
14. CSRF Cross Site Request Forgery
15. Buffer overflow
16. Captcha testing

TEXT BOOK(S):

1. IT Application Security (IBM ICE Publications)

4.16 213CSE4307: DIGITAL FORENSICS

213CSE3306	**DIGITAL FORENSICS**	**L** 4	**T** 0	**P** 2	**X** 0	**C** 4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand computer forensics and apply different forensics software to verify incidents and recover data.
CO2: Analyze the different network internet forensics techniques and apply suitable forensics techniques to email, messenger and browser.
CO3: Create legal documents of different forensics performed on various platforms.
CO4: Understand mobile forensics and apply mobile forensics on different mobile platforms and also understand forensics on digital camera and apply suitable steganography tools.
CO5: Analyze various operation systems malwares and apply suitable reverse engineering tools and techniques.
CO6: Create solutions for real time applications by using suitable digital forensics techniques.
CO7: Implement various forensics techniques in an efficient manner.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S	M								M	S	L
CO2	S	S	S	M								M	S	L
CO3	S	S	S	M								M	S	L
CO4	S	S	S	M								M	S	M
CO5	S	S	S	M								M	S	L
CO6	S	S	S	M	S	L	L	M	M	M	L	M	S	M
CO7	S	S	S	M	S	L	L	L	M	S	L	M	S	S

UNIT I: Computer Forensics Standard Procedure, Incident Verification, System identification, Recovery of Erased and damaged data, Disk imaging and preservation, Data encryption and compression, Automated search techniques, Forensic software

UNIT II: Network Internet Forensics Tracking network traffic, Reviewing Network Logs, Tools, Performing Live Acquisitions, Order of volatility, Standard Procedure, Internet World wide web threats (Email, Chat-rooms, Search Engines, Hacking illegal access, Obscene and indecent transmission, Extortion threats), Domain Name Ownership Investigation, Reconstructing Past Internet Activities and Events, Email Forensics: E-mail Analysis, Email Headers and Spoofing, Laws Against Email Crime. Messenger

Forensics: AOL, Yahoo, MSN, and Chats, Browser Forensics: Analyzing Cache and Temporary Internet Files, Cookie Storage and Analysis, Web Browsing Activity Reconstruction.

UNIT III: Forensic Investigation, Evidence Presentation and Legal aspects of Digital Forensics Authorization to collect the evidence, Acquisition of evidence, Authentication of the evidence, Analysis of the evidence, reporting on the findings, Testimony, Laws regulations - Information Technology Act, Giving evidence in court

UNIT IV: Mobile Memory Forensics, Steganography Collecting and Analyzing Cell Phone, PDA, Blackberry, iPhone, iPod, iPad and MP3 Evidence, Analyzing CD, DVD, Tape Drives, USB, Flash Memory, and other Storage Devices, Digital Camera Forensics, Reconstructing Users Activities, Recovering and Reconstructing Deleted Data, Steganography Tools and Tricks, Data Hiding, Data Recovery, Memory Data Collection and Examination Extracting and Examining Processes.

UNIT V:Malware Analysis Analyzing Live Windows System for Malware, Analyzing Live Linux System for Malware, Analyzing Physical and Process Memory Dumps for Malware, Discovering and Extracting Malware from Windows Systems, Discovering and Extracting Malware from Linux Systems, Rootkits and Rootkit Detection and Recovery, Reverse Engineering Tools and Techniques

TEXT BOOK(S):

1. Digital Forensics(IBM ICE Publications).

4.17 213CSE4308: IT NETWORK SECURITY

213CSE3307	**IT NETWORK SECURITY**	**L** 4	**T** 0	**P** 2	**X** 0	**C** 4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand network standards, layers and its characteristics, LAN/WAN technologies, topologies and protocols.
CO2: Apply various network protocols for securing communication in LAN/WAN.
CO3: Understand various network devices in Internet, intranet, Extranet components and its security solutions.
CO4: Analyze various network services for remote access, telecommuting and WAN technologies.
CO5: Apply network management tools for monitoring and penetration.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S									S	S	
CO2	S	S	S	M	M							S	S	
CO3	S	S	S									S	S	
CO4	S	S	M									S	S	L
CO5	S	S	S	S	S	M		M	S	M	M	S	S	

UNIT I: Securing Communications and LAN/WAN Networks-I International Organization for Standardization/Open Systems Interconnection (ISO/OSI) Layers and Characteristics, LANs vs. WANs, Network Cabling, Wireless, LAN Technologies (Ethernet, Token Ring, and FDDI), Network Topologies, Network Protocols

UNIT II: Securing Communications and LAN/WAN Networks-II Lan Manager / Microsoft Network / NT Domains, TCP/IP, Weaknesses, Routing Protocols, PPP (Point to Point Protocol), DNS (Domain Name Service), NIS, NIS + (Network Information Service), DHCP (Dynamic Host Configuration Protocol), NFS (Network File System), Appletalk, SNA, IPX/SPX, OSI protocols, X.25, DECNET, Telephone/Fax Network.

UNIT III: Physical network types & Internet/Intranet/Extranet components Ethernet, Leased lines, FDDI, ATM, Hubs, Bridges, Routers, Modems, Gateways, Firewalls, Internet Email Gateway, Permission for external connections, Remote Access Security Management, Network and Protocol Security Mechanisms (VPN, Secure Communications Protocols, E-Mail Security Solutions, Dial-Up Protocols, Authentication Protocols)

UNIT IV: Network Services Remote Access and Telecommuting Techniques (Frame Relay), Other WAN Technologies (SMDS, X.25, ATM, HSSI, SDLC, HDLC, ISDN), Avoiding Single Points of Failure (Redundant Servers, Failover, RAID)

UNIT V: Network Management / Monitoring and Penetration Testing IBM Netview, HP Openview, Sun NetManager. Introduction to Penetration Testing

TEXT BOOK(S):

1. IT Network Security (IBM ICE Publications).

4.18 213CSE4309: IT DATA SECURITY

213CSE3308	IT DATA SECURITY	L 4	T 0	P 2	X 0	C 4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the various factors and processes for the data security threat processes.
CO2: Understand the different security techniques for handling the network and web applications.
CO3: Apply the various techniques to measure the data security threats.
CO4: Analyze the various techniques for ensuring the security threats in database and web applications.
CO5: Understand the different counter measures for network and web applications.
CO6: Develop the various threat technique for the network applications.
CO7: Implement the threat techniques for wireless network and bluetooth applications.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M	M									M	S	L
CO2	S	M	M									M	S	L
CO3	S	S	S								M	S	S	L
CO4	S	S	S								M	S	S	L
CO5	S	M	S									M	S	L
CO6	S	S	S	S	S	M	M	L	M	L	S	S	S	L
CO7	S	S	S	S	S	M	L	L	M	L	S	S	S	L

UNIT I: Data Security Threats-I Data security – background, Data security – a need, Data security – its importance, Factors for implementing a robust data security, Data security processes, Data security threats, Network Driven Threats to Data Security, Phishing, Identity Theft.

UNIT II: Data Security Threats-II More Network based Threat types, Cryptographic Threats, Threats to database security, Banking frauds, Threats to web- application, Physical security threats, Hacking and social engineering, Threats – wireless network, Threats – bluetooth devices, Threats in Current technological environment, Data security - benefits.

UNIT III: Data Security Threat techniques-I Threat techniques - an introduction, Malware threat techniques, Network based threat techniques - botnet, Network

Based Threat Techniques - PHISHING, Network Based Threat Techniques - SNIFFING, Network Based Threat Techniques – PASSWORD ATTACK, Transmission interception.

UNIT IV: Data Security Threat techniques-II Cryptographic Threat Techniques, Database Threat Techniques, Threat technique - sqlinsjection, More Database Threat Techniques, Banking Fraud Techniques, Web-application Threat Techniques, Web-application Threat Techniques – More, Cross-site Scripting Forgery - XSS, Physical security threat techniques, Wireless network threat techniques, DoS attack, Bluetooth device threat techniques.

UNIT V: Countermeasures Introduction to Countermeasures, Importance of data protection, Evolution of mitigation techniques, Countermeasures, Malware counter measures, Network threats - counter measures, Cryptography threats - counter measures, Database threats - countermeasures, Banking frauds - countermeasures, Web application - countermeasures, Physical barrier: - a countermeasure for Physical Threat, Mantrap and perimeter security, Hardware security, Security zone, Partitioning, Biometric and power system, Emi shielding, Hot and cold aisles, Fire suppression, Natural and man-made countermeasures, Insider threat countermeasures, Hacking and social networking - countermeasures, Wireless Network Security Countermeasures, Bluetooth Device Countermeasures.

TEXT BOOK(S):

1. IT Data Security (IBM ICE Publications).

REFERENCE BOOK(S):

1. Law of Data Security and Investigations - SANS
2. Security Data Visualization: Graphical Techniques for Network Analysis - Greg Conti
3. Web Security, Privacy Commerce - Simson Garfinkel, Gene Spafford
4. SANS GIAC Certification: Security Essentials Toolkit (GSEC) - Eric Cole, Mathew Newfield, John M. Millican
5. Information Security Resources - SANS
6. Designing Storage Area Networks – Second Edition – Tom Clark

REFERENCE URL(S):

1. http://ptac.ed.gov/sites/default/files/issue-brief-threats-to-your-data.pdf
2. https://www.cs.purdue.edu/homes/bertino/sdm13.pdf
3. https://ico.org.uk/media/for-organisations/documents/1575/it_security_practical_guide.pdf
4. https://www.ncsc.gov.uk/content/files/protected_files/guidance_files/Cloud-computing-and-data-security.pdf
5. https://www-03.ibm.com/software/sla/sladb.nsf/pdf/KUP12494/$file/KUP12494USEN.pdf

4.19 213CSE4310: ETHICAL HACKING & PENETRATION TESTING

213CSE4310	ETHICAL HACKING & PENETRATION TESTING	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the hacking mechanism for different application sources.
CO2: Understand the various security and risk management techniques for the development of applications.
CO3: Apply the various techniques for evaluating the vulnerability assessment and penetration testing.
CO4: Understand the open source resources for developing attacks using penetration testing tool.
CO5: Develop the web applcation with considereing the various security issues.
CO6: Implement the various tools for evaluating the vulnerabilty assessment process.
CO7: Develop the open source attacks with the help of peneration testing tools.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	M									M	S	M
CO2	S	M	M									M	S	L
CO3	S	S	S								M	S	S	L
CO4	S	M	M									S	S	L
CO5	S	S	S								M	S	S	S
CO6	S	S	S	S	S	M	L	L	M	L	S	S	S	M
CO7	S	S	S	S	S	M	M	L	M	L	S	S	S	S

UNIT I: Introduction to Hacking Introduction, Hacking, Motives, Types of Hackers, Sources of Interest – Internet, Mobile, Cloud, ATM, Types of Online Crimes , Brief introduction to National and International Laws specific to hacking and accessing third party asset, Information Technology Act.

UNIT II: Understanding Security and Risk Management Introduction, Identifying Threats, Worms, Virus, Trojans, Operating System Threats, Web Applications and Databases threats, Network Threats, Social Engineering, Understanding Environment gathering information, Installing and Setting up your System and tools.

UNIT III: Vulnerability Assessment and Penetration Testing (VAPT) Understanding Vulnerability, Consequences of Vulnerabilities, Web Application attack and Audit Frameworks, Executing tools to attack the defence, (List of tools related to Attack will be compiled into the material to cover) Manual Attacks and Automated Attacks.

UNIT IV: Open source resources for Attacks – Penetration Testing Tools Package Management on VM Instance for Penetration testing, installing tools and additional components for hacking remote systems, Wi-Fi, Stress Testing, sniffing and spoofing, password and miscellaneous tools, Tools alone cannot make am attacker a Hacker.

UNIT V: Setting up a web application with exploits Introduction to Web Application with security issues, identifying attack surface, planning the tools and attacking the site, Hacking demonstration and Reporting attacks and vulnerability, Reporting the Vulnerability and recommendation for fixing.

TEXT BOOK(S):

1. Ethical Hacking and Penetration Testing (IBM ICE Publications).

STREAM: INTERNET OF THINGS AND SMART CITY

4.20 213CSE1304: INTRODUCTION TO INTERNET OF THINGS

213CSE1304	INTRODUCTION TO INTERNET OF THINGS	L	T	P	X	C
		4	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To provide students with an overview of the concepts and fundamentals of internet of things.
- To learn the importance of communication standards in the selection, creation, integration and administration of an IoT.
- To understand the concept of IoT security framework and the procedure of access control

COURSE OUTCOMES:

CO1: Inspect the basics of internet of things and its technologies

CO2: Understand the applications, system and networks in IoT terminology.

CO3: Analyse the design of IoT with appropriate hardwares, softwares and sensor devices

CO4: Understand the various communication technologies in IoT

CO5: Understand the security standards in IoT

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M											S	
CO2	S	M											S	
CO3		S	S	L								L	S	
CO4		M	S		S							L	S	
CO5				S		S							S	

UNIT I: INTRODUCTION TO IOT TECHNOLOGIES

IOT Concepts, Introduction to IOT Communications, Telemetry vs IOT, Applications of IOT Communications, People, Processes and Devices, Automation, asset management, telemetry, transportation, telematics. Telemetry and Telemetric; Report location, logistics, tracking and remote assistance; Next generation kiosks, self-service technology; Cellular IOT connectivity services

UNIT II: IOT APPLICATIONS, SYSTEMS AND NETWORKS

IOT Verticals; IOT Hosted Services; IOT Application development.; IOT Connectivity; IOT Software providers, Study of RF Wireless Sensors; Wireless networks; Computer Connected to Internet; Network Devices; Device configuration and management; Exchange information in real time without human intervention.

UNIT III - IOT DESIGN AND SYSTEM ENGINEERING

Discuss IOT Requirements; Hardware and Software; Study of IOT Sensors; Tagging and Tracking; Embedded Products; IOT Design; (U) SIM Card Technology; IOT Connectivity and Management; IOT Security and IOT Communication.

UNIT IV: IOT COMMUNICATION TECHNOLOGIES

Discuss Wireless Sensor Networking (WSN); Cellular Machine-to- Machine (M2M) application networks; Software for M2M Applications, Hardware, IP Based Cellular Networks and 3G, 4G.

UNIT V: IOT SECURITY

Discuss Security & Trust M2M Communications; Secure Communications; M2M Security Framework; Securing Data input/output and internet communication.

15 WEEK COURSE PLAN

Week	Lecture (4 hours)	Pedagogy	Practical (2 hours)	pedagogy
Week 1	IOT Concepts, Introduction to IOT Communications,Telemetry vs IOT, Applications of IOT Communications, People,Processes and Devices, Automation, asset management	Explicit Teaching	Arduino Hardware and Its Types, Configuration	Demonstration

Week 2	telemetry, transportation, telematics, Telemetry and Telemetric,Report location, logistics, tracking and remote assistance	Explicit Teaching	Arduino IDE Installation and Configuring Arduino board with Arduino IDE	Demonstration
Week 3	Next generation kiosks, self-service technology, Cellular IOT connectivity services	Explicit Teaching	Basic Programming in Arduino - pinMode, digitalRead, digitalWrite, analogRead	Demonstration
Week 4	Unit II - IOT APPLICATIONS, SYSTEMS AND NETWORKS IOT Verticals; IOT Hosted Services; IOT Application development, IOT Connectivity; IOT Software providers,	Explicit Teaching	Serial communication, Serial monitor concept - Serial.begin, Serial.print	Demonstration
Week 5	Study of RF Wireless Sensors; Wireless networks, Computer Connected to Internet; Network Devices	Explicit Teaching	data types and delay concept - data types, delay, millis, break	Demonstration
Week 6	Device configuration and management; Exchange information in real time without human intervention	Explicit Teaching	Condition Statement - if, else, elseif	Demonstration
Week 7	UNIT III - IOT DESIGN AND SYSTEM ENGINEERING Discuss IOT Requirements; Hardware and Software, Study of IOT Sensors	Explicit Teaching	Control Statement - for loop, while loop and switch cases	Demonstration
Week 8	Tagging and Tracking; Embedded Products, IOT Design; (U) SIM Card Technology	Explicit Teaching	Blinking a LED	Demonstration
Week 9	IOT Connectivity and Management, IOT Security and IOT Communication	Explicit Teaching	Blink Multiple LEDs – Sequential and Parallel	Demonstration
Week 10	UNIT IV - IOT COMMUNICATION TECHNOLOGIES Discuss Wireless Sensor Networking (WSN), Cellular Machine-to- Machine (M2M) application networks	Explicit Teaching	Blink Multiple LEDs – Sequential and Parallel Using Conditional Loop	Demonstration

Week 11	Software for M2M Applications, Hardware, IP Based Cellular Networks	Explicit Teaching	Blink Multiple LEDs – Sequential and Parallel Using Array	Demonstration
Week 12	3G, 4G	Explicit Teaching	Blinking Tricolor(RGB) LED, Blinking Tricolor(RGB) LED Using Switch Case	Demonstration
Week 13	UNIT V - IOT SECURITY Discuss Security and Trust M2M Communications, Secure Communications	Explicit Teaching	PUSH Button Control	Demonstration
Week 14	M2M Security Framework, Securing Data input/output	Explicit Teaching	Potentiometer Control, Brightness Control of LED Using PWM	Demonstration
Week 15	Internet communication	Explicit Teaching	Seven Segment Display and Design of Counter	Demonstration

EXPERIMENTS:

1. Study of Arduino Hardware and Its Types, Configuration
2. Arduino IDE Installation and Configuring Arduino board with Arduino IDE
3. Basic Programming in Arduino - pinMode, digitalRead, digitalWrite, analogRead, Serial communication, Serial monitor concept - Serial.begin, Serial.print, data types and delay concept - data types, delay, millis, break, Condition Statement - if, else, elseif, Control Statement - for loop, while loop and switch cases
4. Arduino first program - Blinking a LED
5. Blink Multiple LEDs – Sequential and Parallel
6. Blink Multiple LEDs – Sequential and Parallel Using Conditional Loop
7. Blink Multiple LEDs – Sequential and Parallel Using Array
8. Blinking Tricolor(RGB) LED,
9. Blinking Tricolor(RGB) LED Using Switch Case
10. PUSH Button Control
11. Potentiometer Control.
12. Brightness Control of LED Using PWM

13. Interfacing Seven Segment Display
14. Design of Counter

TEXT BOOK(S):

1. Introduction to Internet Of Things(IBM ICE Publication)

REFERENCES:

1. Learning Internet of Things, by Peter Waher, Kindle Edition, 2015.
2. Internet of Things, by Jeeva Jose , Kindle Edition, 2018.
3. Internet of Things: A Hands-On Approach Paperback – 2015, by ArsheepBahga and Vijay Madisetti, Orient Blackswan Private Limited.

4.21 213CSE3310–INTRODUCTION TO SENSOR TECHNOLOGY AND INSTRUMENTATION

213CSE3310	INTRODUCTION TO SENSOR TECHNOLOGY AND INSTRUMENTATION	L	T	P	X	C
		4	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the working principles of basic electronics components
- To provide students with an overview and the importance of sensors and actuators.
- To understand the concept of data acquisition system with real time applications

COURSE OUTCOMES:

CO1: Inspect the basic properties of resistance, capacitance and inductance towards internet of things and its technologies

CO2: Understand the working principles of amplifier circuits and its classifications

CO3: Analyze the different types of sensor and its applications

CO4: Understand the basic idea of sensor based data acquisition system

CO5: Examine the different types of actuators

CO6: Design the various applications using sensors

CO7: Design the various applications using actuators

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M											S	
CO2	S	M											S	
CO3		S	S	L	S							L	S	
CO4		M	S		L							L	S	
CO5			S	L	S								S	
CO6	L		M	S	S				S	S	M	L	S	
CO7	L		M	S	S				S	S	M	L	S	

UNIT I: RESISTANCE AND CAPACITANCE

Resistance, Ohm's Law, Kirchhoff's Law, Capacitance, Induction, Thermoelectric Effects, Types of thermoelectric effects, See-beck Effect, Pettier Effect, Thomson Effect, Piezo-electric Effect, Hall Effect, Photoelectric Effect, Temperature and Thermal Properties of Materials, Types of temperature sensors, Electro-mechanical, DynamicModels of Sensor Elements, Mechanical Elements, Thermal Elements, Electrical Elements.

UNIT II: AMPLIFIER CIRCUITS

Amplifier circuits, Magnetic amplifier, Transistor amplifier, Voltage amplifier and power amplifier, Operational amplifier, Voltage Follower (or Unity Gain Buffer), Bridgecircuits, Analog-to- digital converters, A-to-DConversionMethods –Integrating(Dual Slope) ADC, Noise in sensors and circuits, Internal noise sources, Low-power sensors, Powering Sensors, Batteries for Low-Power Sensors.

UNIT III: SENSORS

Sensors, Occupancy and Motion Detectors, Motion Detectors, Occupancy Detectors, Force Sensors, Strain Sensors, Tactile sensors, Pressure sensors,Pressure SensorDesigns, Chemicalsensors,Temperature Sensors.

UNIT IV: DATA ACQUISITION IN SENSORS

Introduction to data acquisition in sensors, Data Acquisition System,Sensors, Different Types of Sensors, need of sensors, DAQ device, Key MeasurementComponents of a DAQ Device, Computer Bus, Introduction to SCADA systems, SCADA requirements, Supervisory computers, Programmable logic controllers, Communication infrastructure, PLC/RTU programming, PLC commercial integration, SCADA Architectures, SCADA architecture development, Monolithic SCADA Systems, Distributed SCADA systems, Networked SCADA Systems, Internet of things, Functions of SCADA, Real-Time Monitoring and Control using SCADA, Applications of SCADA, Benefits of SCADA, Scheduling, Classification of scheduling, On-line Scheduling, fixed versus Dynamic Priority Algorithms, Rate-Monotonic, Deadline-monotonic priority, Dynamic- Priority Algorithms.

UNIT V: ACTUATORS

Introduction to actuators, Types of Actuator, Electromagnetics, Electromagnetic Force, Solenoid, Voice Coil, DC Motor, DC Motor: Types, Brushless DC Motor, AC Motor: Rotating magnetic field, AC Motor: Synchronous Motor, AC Motor: Three-Phase induction motor,AC Motor: Induction motor, Stepper motor, Solid State Switches.

15 WEEK COURSE PLAN

Week	Lecture (4 hours)	Pedagogy	Practical (2 hours)	pedagogy

Week 1	UNIT I – RESISTANCE AND CAPACITANCE Introduction - Resistance, Ohm's Law, Kirchhoff's Law, Capacitance, Induction, Thermoelectric Effects, Types of thermoelectric effects	Explicit Teaching	Effect of Resistance in Serial and Parallel, Verification of Ohm' S Law	Demonstration
Week 2	See-beck Effect, Pettier Effect, Thomson Effect, Piezoelectric Effect, Hall Effect, Photoelectric Effect, Temperature and Thermal Properties of Materials	Explicit Teaching	Verification of Krichoff's Voltage and Current Law	Demonstration
Week 3	Types of temperature sensors, Electro-mechanical, Dynamic Models of Sensor Elements, Mechanical Elements, Thermal Elements, Electrical Elements	Explicit Teaching	Smart Operations Based on Temperature Sensor	Demonstration
Week 4	UNIT II- AMPLIFIER CIRCUITS Amplifier circuits, Magnetic amplifier, Transistor amplifier, Voltage amplifier and power amplifier, Operational amplifier, Voltage Follower (or Unity Gain Buffer)	Explicit Teaching	Smart Operations Based on Potentiometer Sensor	Demonstration
Week 5	Bridge circuits, Analog-to-digital converters, A-to-D Conversion Methods – Integrating (Dual Slope) ADC	Explicit Teaching	Smart Operations Based on Photoresistor Sensor	Demonstration
Week 6	Noise in sensors and circuits, Internal noise sources, Low-power sensors, Powering Sensors, Batteries for Low-Power Sensors	Explicit Teaching	Smart Operations Based on Photodiode Sensor	Demonstration
Week 7	UNIT III - SENSORS Introduction - Sensors, Occupancy detecors	Explicit Teaching	Smart Operations Based on Ambient Light Sensor	Demonstration
Week 8	Motion Detectors, Force Sensors, Strain Sensors, Tactile sensors	Explicit Teaching	Ultrasonic Sensor Based Distance Measurement	Demonstration
Week 9	Pressure sensors, Pressure Sensor Designs, Chemical sensors, Temperature Sensors	Explicit Teaching	PIR Sensor Based Motion Detector	Demonstration

Week 10	UNIT IV - DATA ACQUISITION IN SENSORS Introduction to data acquisition in sensors, Data Acquisition System, Sensors, Different Types of Sensors, need of sensors, DAQ device, Key Measurement Components of a DAQ Device, Computer Bus, Introduction to SCADA systems, SCADA requirements, Supervisory computers	Explicit Teaching	Gas and Alcohol Sensor Based IOT Application	Demonstration
Week 11	Programmable logic controllers, Communication infrastructure, PLC/RTU programming, PLC commercial integration, SCADA Architectures, SCADA architecture development, Monolithic SCADA Systems, Distributed SCADA systems, Networked SCADA Systems, Internet of things, Functions of SCADA, Real-Time Monitoring and Control using SCADA	Explicit Teaching	Tilt Sensor Based IOT Application	Demonstration
Week 12	Applications of SCADA, Benefits of SCADA, Scheduling, Classification of scheduling, On-line Scheduling, fixed versus Dynamic Priority Algorithms, Rate-Monotonic, Deadline-monotonic priority, Dynamic- Priority Algorithms	Explicit Teaching	Infrared Sensor Based IOT Application	Demonstration
Week 13	UNIT V - ACTUATORS Introduction to actuators, Types of Actuator, Electromagnetics, Electromagnetic Force, Solenoid, Voice Coil, DC Motor, DC Motor: Types, Brushless DC Motor	Explicit Teaching	Control DC-Motor Using Arduino	Demonstration
Week 14	AC Motor: Rotating magnetic field	Explicit Teaching	Control Servo Motor Using Arduino	Demonstration

Week 15	IAC Motor: Three-Phase induction motor, AC Motor: Induction motor, Stepper motor, Solid State Switches	Explicit Teaching	Control Stepper Motor Using Arduino	Demonstration

EXPERIMENTS:

1. Write an Arduino code to verify the function of photoresistor sensor.
2. Write an Arduino code to verify the functions of photodiode.
3. Write an Arduino code to verify the functions of ambient light sensor.
4. Write an Arduino code to verify the functions of IR sensor.
5. Write an Arduino code to verify the functions of Ultrasonic Distance sensor.
6. Write an Arduino code to verify the functions of PIR sensor.
7. Write an Arduino code to verify the functions of Tilt sensor.
8. Write an Arduino code to verify the functions of Gas sensor.
9. Write and implement an Arduino code to sense the moisture level in the soil using FC-28 soil moisture sensor.
10. Write and implement an Arduino code to sense the temperature level using LM35 temperature sensor.
11. Write and implement an Arduino code to sense the temperature and humidity level using DHT11 temperature sensor.
12. Write and implement an Arduino code to sense and measure the acceleration using GY-521 accelerometer.
13. Write and implement an Arduino code to sense the pressure level using BMP180 pressure sensor.
14. Write and implement an Arduino code to control the DC motor.
15. Write and implement an Arduino code to control the stepper motor.

TEXT BOOK(S):

1. SENSOR TECHNOLOGY & INSTRUMENTATION (IBM ICE PUBLICATIONS)

4.22 213CSE3311–WIRELESS SENSOR NETWORKS AND IOT STANDARDS

213CSE3311	WIRELESS SENSOR NETWORKS AND IOT STANDARDS	L	T	P	X	C
		4	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Understand the perspective of a WSN and the design principles of the WSN
- Learn about design and implement a low energy consumption wireless network for sensor applications
- Differentiate the function of the MAC layer and the Physical layer especially with reference to WSN
- Gain knowledge on network layer and the associated routing protocols
- Gain an insight into architect a sensor network and a wireless sensor network for different types of applications
- Learn on introduction to Hardware design of a WSN node
- Gain knowledge on Operating Systems for WSN

COURSE OUTCOMES:

CO1: Understand the working principle wireless sensor networks and its characteristics

CO2: Analyze the different layer in WSN architecture

CO3: Analyze the applications of WSN related to agriculture

CO4: Analyze the performance of routing protocol for WSN

CO5: Demonstrate the performance of WSN using modern simulation tools

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M										M	S	
CO2	S	M						M				M	S	
CO3	S	M	M	L		M						M	S	
CO4	S	M	L	L								M	S	
CO5	S	S	S	S	S	S	S	L	M	M	S	S	S	

UNIT I - CHARACTERISTICS OF WSN

Communication, Wireless sensor networks, Characteristics of WSN, Fault tolerant WSN, Scalability, WSN topologies, Microcontroller, Transceiver, Energy consumption in a WSN, Transducer, Energy consumption, Energy scavenging, Routing protocols, WSN operating systems, TinyOS, Contiki OS, MANTIS, Environments, Network architecture, WSN network architecture, Design principles for a WSN, Gateway.

UNIT II – PHYSICAL LAYER

OSI models, OSI models and WSN, Session layer, Physical link layer, RF communication, Physical layer, Data encoding, Channel encoding, PHY standard, MAC layer, Contention protocols, Sleep MAC, Berkeley MAC, Low power listening, Clear channel assessment, Reservation based protocols, TRAMA protocol, Adaptive election, Hardware limitations, Energy consumption, Energy consumption Deep Sleep, Network failures.

UNIT III - APPLICATIONS OF WSN

Application of WSN, CoAP, IPv6, Unicast, Multicast and Anycast, Hexadecimal Number System, Address Structure, Block Diagram of IPv6 Fixed Header, Global Unicast Address, Unique Local Address, Scope of different address, Transition to IPv6, Tunnelling, Network address Translation, 6LoWPAN, Building automation, BAS Integration with WSN, Object Access Services, Analysis of Stack usage - Energy, BMS types of equipment, BMS and WSN players, Smart Agriculture, Crop monitoring, Composting, Smart Agriculture – Green House, Hydroponics, Perimeter monitoring, Video surveillance and analytics, Item and object tracking, Tag and trace, Inventory management system, Takt time.

UNIT IV - ROUTING PROTOCOLS

IPv6 - Routing, The routing protocols classification, ICMPV6 vs DHCPV6 Vs DNS, Routing Protocol and Data Centric Networking, Challenges in WSNs, Network Structure Categorization, "Data-centric and Flat-Architecture Protocols", Illustration of Data Centric Routing, Flooding, Gossiping, Sensor Protocols for Information via Negotiation (SPIN), SPIN PP, SPIN EC (Energy Conserve), SPIN BC, SPIN - Conclusion, Directed Diffusion, Negative reinforcement in direct diffusion, Hierarchical Protocols, LEACH, LEACH: Adaptive Clustering, Algorithm, Algorithm Summary, LEACH Network-An Example, Geographical Routing Protocols, MECN and SMECN, Relay region Concept in MECN, Geographical Forwarding Schemes for Lossy Links, Hop selection algorithms, PRADA, QoS-Based Protocols, SAR, Minimum Cost Path Forwarding, SPEED.

UNIT V - IOT OPEN SOURCE TOOLS

Overview, Main components to build IoT applications, Various IoT tools available for development, ARM MBED, MBED OS, Features of MBED OS, IoT CLOUD SERVICES, NODE-RED, Admin HTTP API, Errors, Methods, IoTivity, IoTivity and IoTivity-Lite Comparison, IoTivity-Main Stack, IoTivity-LITE Stack, Distributed Service Architecture, Distributed Service Broker, Distributed Service Link, nodeAPI, Devices for monitoring and controlling.

EXPERIMENTS:

1. Interfacing of Input Device with Microcontroller.
2. Interfacing of Output Device with Microcontroller.
3. Multitasking of Microcontroller.
4. Social Distance Detector (Corona Kawach).
5. Controlling Electrical Appliances Using Microcontroller.
6. Controlling DC Motor Using Relay.
7. Weather Monitoring System.
8. Controlling Electrical Appliances from Any Place of The World (IOT Application).
9. Uploading Sensor Data at Cloud and Fetching it from Any Place of World (IOT Application).
10. Contiki OS And Cooja Simulator for WSN.
11. Basic Programming in Cooja Simulator.
12. Hello World in Contiki.
13. LED Blinking.
14. Button Control LED.
15. Temperature Monitoring.

TEXT BOOK:

1. WIRELESS SENSOR NETWORKS(WSN) & IOT STANDARDS (IBM ICE PUBLICATIONS)

4.23 213CSE3312: CLOUD COMPUTING ARCHITECTURE AND DEPLOYMENT MODELS

213CSE3312	CLOUD COMPUTING ARCHITECTURE AND DEPLOYMENT MODELS	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OBJECTIVES:

- To provide students with an overview of the concepts and fundamentals of cloud computing architecture.
- To learn the importance of different cloud deployment models.
- To understand the concept of cloud services and its characteristics.

COURSE OUTCOMES:

CO1: Inspect the basics of cloud computing and its technologies

CO2: Understand the need of migration to cloud and cloud deployment in industry

CO3: Analyse the public cloud deployment model and its function

CO4: Analyse the private and hybrid cloud deployment models and its function

CO5: Understand the different architecture of cloud service and its characteristics

CO6: Demonstrate OpenStack architecture with both CLI and API functionalities

CO7: Implement suitable use-cases for OpenStack

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M											S	
CO2	S	M											S	
CO3		S	S	L	S							L	S	
CO4		M	S		L							L	S	
CO5			S	L	S								S	
CO6	L		M	S	S				S	S	M	L	S	
CO7	L		M	S	S				S	S	M	L	S	

UNIT 1 INDUSTRY TRENDS AND THE FUTURE OF CLOUD COMPUTING

Analysis of industry trends, Evolution from IaaS to PaaS applications, Convergence of IaaS and SaaS providers, Trends leading from private to hybrid clouds, The future of cloud computing: Hybrid clouds and cloud brokering, Application transformation: fully multi-threaded, multi provider, dynamically scalable applications, Self-service administration: consolidated application control panels, Software-defined networking, Software-defined data centre, Big Data and analytics,The Internet of Things.

UNIT II CONSIDERATIONS FOR MOVING TO CLOUD CLOUD DEPLOYMENT

How does cloud computing work? Dynamic cloud with service composition and patterns, composable business, Migration to cloud: It is all about workloads, Virtualization of servers, network, and storage, the relentless pursuit of automation, Adding customer visibility and transparency into cloud operations, monitoring, and reports. Accessing cloud services, Data sovereignty and on-shore support operations, New backup and recovery techniques, Cloud operational changes in an Information Technology Infrastructure Library model (ITIL). Operational transformation best practices. Migrating applications to cloud, 5 key success factors for cloud implementation, Consume-versus-build decision, building your own cloud—lessons learned, including architecture examples and guidance, managing scope, releases, and customer expectations, Redundancy, continuity, and disaster recovery, Using existing operational staff during deployment, Cloud Deployment best practices.

UNIT III PUBLIC CLOUD DEPLOYMENT MODELS

What is a Public Cloud? Illustration of Public Cloud, Why Public Cloud, Advantages of Public Cloud, Limitations of Public Cloud, Low degree of security and control, Lack of control on infrastructure, configuration, Network latency and accessibility concerns, Highest long term cost, Public v/s Private, Journey into Public Cloud, Revisit the idea of adopting public cloud, Cloud vendor selection, Migrating to Cloud, Cloud vendor selection, SLA – Service Level Agreements, Credits/Compensation terms, Credit process, Disaster recovery plan, Exclusions, Security and Privacy, Periodic upgrade and maintenance, Data location and Jurisdiction, Pricing and Measurability, Interoperability and Lock-in, Exit process/Termination policies, Proven track record, Public cloud vendors, Case studies.

UNIT IV PRIVATE AND HYBRID CLOUD DEPLOYMENT MODELS

What is a Private Cloud? Illustration of Private Cloud, Advantages of Private Cloud, Limitations of Private Cloud, Service Management, Journey into Private Cloud, Planning and Strategy, Standardization, Virtualization, Automation, Cloud, Case study – VMware vCloud, Case Study – IBM SmartCloud Entry, Private cloud. What is a Hybrid Cloud? Why Hybrid Cloud, Illustration of Hybrid Cloud, Advantages of Hybrid Cloud, Challenges of Hybrid Cloud, Develop and manage hybrid workloads, Developing applications for hybrid cloud, Develop applications using PaaS, Managing hybrid workloads, Journey into Hybrid Cloud, Step 1: Asses current IT infrastructure and business, Step 2: Explore cloud computing, Step 3: Create cloud deployment strategy plan, Step 4: hybrid cloud implementation.

UNIT V IAAS, PAAS AND SAAS

Infrastructure as a Service (IaaS), Characteristics of IaaS, Comparing ISPs and IaaS, IaaS case studies, IaaS enabling technology, The trusted cloud, IaaS as the best option, IaaS may not be the best option, PaaS: Platform as a Service, PaaS characteristics, Integrated lifecycle platforms, Anchored lifecycle platforms, Enabling technologies as a platform, Case studies: Integrated lifecycle platform, PaaS as the best option, PaaS as may not be the best option, Software as a Service (SaaS), SaaS origin, Evolution of SaaS: Salesforce.com's approach, Characteristics of Software as a Service (SaaS), SaaS economics and the ecosystem, Types of SaaS platforms, SaaS: Providers, Collaboration as a service, Enabling and management tools as a service, Monitoring and management tools as a service, SaaS as the best option, SaaS may not be the best option.

EXPERIMENTS:

1. OpenStack Installation.
2. Familiarize with OpenStack dashboard.
3. Cloud Project Management.
4. OpenStack user management.
5. Upload a qcow2 image (Machine image).
6. Upload an ISO image.
7. Creating a new key pair.
8. Enabling SSH on default security group.
9. Launch a new instance using qcow2 Image.
10. Deploy Linux VM from an ISO Image.
11. Create and attach a volume to an instance.
12. Create an instance Snapshot.
13. Deploy a VM from an image snapshot.
14. Volume snapshot.
15. Detach and attach volume.
16. Create Flavor.
17. Controlling the state of an instance (pause, suspend, reboot).
18. Deleting an instance.

TEXT BOOK(S):

1. CLOUD COMPUTING DEPLOYMENT MODELS, IBM ICE PUBLICATION, 2019.
2. CLOUD COMPUTING ARCHITECTURE, IBM ICE PUBLICATION, 2019.

4.24 213CSE4311: ANALYTICS FOR IOT

213CSE4311	ANALYTICS FOR IOT	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: To understand the concepts behind the descriptive analytics of data.
CO2: Apply the technologies and tools of BI.
CO3: Explore and Analyz Data data using descriptive analytics techniques.
CO4: Apply different predictive,Descriptive and text analytic chart models.
CO5: Recognize and apply various suitable IoT tools for use cases.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S								S				S	
CO2								M					S	
CO3	S	S	S	M	S				M	S		M	S	
CO4	S	S			S					S			S	
CO5	S		S		S					M		M	S	

UNIT I: Introduction to Analytics for IoT and Descriptive analytics - deep dive What is Analytics? - Capabilities of analytics, Analytics ecosystem for IoT, Types of analytics - Descriptive Analytics /BI, Predictive Analytics / DM, Prescriptive Analytics / Optimization, Cognitive Analytics. Intro to Descriptive analytics/ for IoT, Benefits of BI, Maximise Value From BI Systems, Strategy and Business Intelligence, Five key areas of strategy, Planning a BI Project, BI Design and Development, Engagement Activities, Pre-Engagement Activities, Business Environment, Engagement Process, Project Tasks, Task 1- Knowledge Capture Goals, Discuss Business Objectives Prior Learning, Interview key stakeholders, Task 2 - Consolidate Findings, Create logical design, Task 3 - Map the Customer Situation, Current Environment, Business/Functional, Requirements Sample Diagram, Task 4 - Methodology Approach, Task 5 - Standards Governance, Task 6 - Sections, Milestones, and Tasks, Task 7 – Proof of Concept (POC), Task 8 – Table Creation, Task 9 – OLAP Creation, Task 10 – Three Final Deliverables.

UNIT II: BI framework for IoT BI Architecture- Centralized versus Decentralized architecture, BI Architecture Alternatives, Phased and Incremental BI Roadmap, System sizing, measurement and dependencies, Authentication, Authorization and Access permissions, Server Administration, Data Backup and Restoring BI framework for IoT, Ecosystem preparation – device, network and software layer integrations, Data mart framework, Data layer framework, Presentation layer framework.

UNIT III: Applying Descriptive analytics for IoT Data for analytics - Decision driven data - Exploring and Analyzing Data, Setting up data for BI IoT data for Analytics - Sensor data – Problem of plenty, Challenges of data – categorization of relevancy, Capture of data, Storage and retrieval – need for data warehouse/ marts ETL strategy for IoT data, Challenges of ETL layer, Building data marts for IoT data, What is a data warehouse?, Data Warehouse - Subject Oriented, Data Warehouse – Integrated, Data Warehouse – Time Variant, Data Warehouse – Non Volatile, Data Warehouse Usage 2-13, From tables and spreadsheets to data cubes, Multidimensional Data, Conceptual Modeling of Data Warehouses, Data Warehouse Design Process, Three-Tier Data Warehouse Architecture, Three Data Warehouse Models, Data Warehouse Development, Multi-Tiered Architecture, Metadata Model for IoT.

UNIT IV: Reports and Dashboards for IoT Multidimensional analysis techniques - Data Analysis and OLAP, OLAP Server Architectures, Data Cube, Discovery-Driven Data Cubes, OLTP vs. OLAP, Business Query, Dashboards Development – Definition, Dashboard Types, Evolution of Dashboards, Layers of Information, Dashboard Design, Dashboard Examples, Display Media for Dashboards, Reports - Building Reports, List Report, Crosstab Report, Chart Report, Map Report, Data group, sort and Filters, Add calculations to report, Conditions and Aggregations in Report, Drilling in report, Run report – on demand or schedule, Charts Graphs, Parts of a Graph, Chart Type – Bar Chart, Chart Type – Line, Chart Type – Pie, Chart Type – Area, Chart Type – Scatter, Presenting IoT data analysed- Examples of dashboards on IoT analytics, Examples of reporting IoT analytics, Examples of charts and graphs on IoT analytics.

UNIT V: Cloud Big data Analytics for IoT and Analytics for IoT – Tools and Use cases Overview of Big data in IoT analytics - Introduction to Big data, Big data and IoT, BI from Big data for IoT, Overview of cloud in IoT analytics - Introduction to Cloud computing, IoT on cloud, Integration of devices on cloud for analytics, Building analytics for IoT, Introduction to various tools in BI, Introduction to Data modelling tools, Introduction to ETL tools, Introduction to Data mart building tools, Introduction to Data visualization and analytics tools, Use cases for IoT analytics, Use case for data capture and extraction, Use case for data marts and data warehouse, Use case for analytical reporting, Use case for backward integration of analytics.

TEXT BOOK(S):

1. Analytics for IoT (IBM ICE Publications).

4.25 213CSE4312: SMARTER CITY

213CSE4312	SMARTER CITY	L	T	P	X	C
		4	0	2	0	4
Pre-requisite : NIL **Course Category :** Program Elective **Course Type :** Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the smarter city framework.
CO2: Design and apply a suitable solution for home automation.
CO3: Design and apply smart street light, pipeline leakeage detection and process analytics of gas, force and humidity.
CO4: Design and apply smart solution for traffic monitoring and control.
CO5: Design and apply a suitable solution for environmental control.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M										M	S	
CO2	S	S	S	S	S	S						S	S	
CO3	S	S	S	S	S	S	S	S		L		S	S	
CO4	S	S	S	S	S	S	S	S	S	L	M	S	S	
CO5	S	S	S	S	S	S	S	S	S	L	M	S	S	

UNIT I: INTRODUCTION Introduction to Smart solutions; Smarter City Framework.

UNIT II: Building and Home Automation Access Control- access control HMI, Light & Temperature Control- Heat meter, Energy Optimization- HVAC Air Handling unit (AHU), Predictive maintenance, Connected Appliances- motor control, LED Light control .

UNIT III: Smart Cities 1 Residential E-meter-AMR, Smart Street Lights-LED Lighting via PLC, Pipeline Leak detection- process analytics-pH, Gas, Concentartion, Force & humidity.

UNIT IV: Smart Cities 2 Traffic Control, Surveillance Cameras- IP Cameras, Centralized and Integrated Systems Control – Digital Signage, Structural analysis, Smart Parking.

UNIT V: Smart Environment Waste management, Fire detection, Air pollution, Snow level monitoring, Landslide and avalanche prevention, Earthquake and tsunami early detection.

TEXT BOOK(S):

1. Smarter City (IBM ICE Publications).

STREAM: NETWORKS AND SECURITY

4.26 213CSE1305: NETWORK AND INFORMATION SECURITY

213CSE1305	NETWORK AND INFORMATION SECURITY	L	T	P	X	C
		3	0	2	0	4
Pre-requisite : Computer Networks **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

To enable students to understand the Information security's role, threats, elements of cryptography, protocols, architectures and technologies for secure systems and services.

COURSE OUTCOMES:

CO1: Examine the security architecture, services and mechanisms.

CO2: Apply the knowledge of number theory in public key cryptography.

CO3: Analyze the various data integrity algorithms.

CO4: Interpret the various internet and network security mechanisms.

CO5: Evaluate various system security mechanisms.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S	S		S	S	M	L					S	S	
CO3	S	S	S	S	S	S	M	L			S	M	S	
CO4	S	S	S	S	S	M	L				S	M	S	
CO5	S	S	S	S	S	M	L				S	M	S	

UNIT I: Introduction

An Overview of Computer Security - OSI Security Architecture - Security Services - Security Mechanisms - Security Attacks - Classical Encryption Techniques - Block Ciphers and Data Encryption Standard - Advanced Encryption Standard.

UNIT II: Public Key Cryptosystems

Number Theory- Block Cipher Operation - Public Key Cryptography and RSA -Other Public Key Cryptosystems - Diffie Hellman Key Exchange - Elgamal Cryptosystems - 120Elliptic Curve Cryptography.

UNIT III: Data Integrity Algorithms

Cryptographic Hash Function - Hash Function based on Cipher Block Chaining-Secure Hash Algorithms -SHA3 - Message Authentication Code HMAC - DAA and CMAC - Authenticated encryption - Digital signature.

UNIT IV: Network and Internet Security

Transport Level security - Secure Socket Layer - Transport Layer Security HTTPS -Secure Shell - E-mail Security - Pretty Good Privacy - S/MIME - Domain Keys Identified Mail - IP Security.

UNIT V: System Security

Intrusion detection system, Malicious software Viruses Worms - Distributed denial of service Attacks -Firewalls Control Hijacking attacks integer overflow ,More Control Hijacking attacks format string vulnerabilities, Defence against Control Hijacking-Platform Defences, Defence against Control Hijacking-Run-time Defences, Advanced Control Hijacking attacks.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Introduction to Software Engineering,Project Management Concepts,Software Engineering Paradigms Generic An Overview of Computer Security ,OSI Security Architecture,Security Services	Explicit Teaching	Introduction to Computer Security.
Week 2	Security Mechanisms,Security Attacks - Classical Encryption Techniques	Explicit Teaching and Demonstration	Introduction to various attacks,
Week 3	Block Ciphers and Data Encryption Standard - Advanced Encryption Standard	Demon-stration	Introduction of encrption techniques.

Week 4	Number Theory- Block Cipher Operation - Public Key Cryptography and RSA	Explicit Teaching and Demonstration	Demostration of public key crptography
Week 5	Other Public Key Cryptosystems - Diffie Hellman key exchange	Explicit Teaching and Demonstration	Demostration of Elliptic Curve Cryptography
Week 6	Elgamal Cryptosystems - 120 Elliptic Curve Cryptography	Explicit Teaching and Demonstration	Creating the State diagram,Identify the relationship between various states
Week 7	Cryptographic Hash Function - Hash Function based on Cipher Block Chaining	Demon-stration	Programs using Hash function
Week 8	Secure Hash Algorithms - SHA3 - Message Authentication Code	Explicit Teaching and Demonstration	Programs using Message Authentication Code
Week 9	HMAC - DAA and CMAC - Authenticated encryption - Digital signature	Demon-stration	Demostration of Digital signature.
Week 10	Transport Level security - Secure Socket Layer	Explicit Teaching and Demonstration	Demonstration for Transport Layer Security
Week 11	Transport Layer Security HTTPS -Secure Shell - E-mail Security	Explicit Teaching	Demonstration for E-mail Security
Week 12	Pretty Good Privacy - S/MIME - Domain Keys Identified Mail - IP Security	Explicit Teaching and Demonstration	IP Security
Week 13	Intrusion detection system, Malicious software Viruses Worms - Distributed denial of service Attacks	Explicit Teaching and Demonstration	Demonstration of intrusion detection system
Week 14	Firewalls Control Hijacking attacks integer overflow ,More Control Hijacking attacks format string vulnerabilities	Explicit Teaching and Demonstration	Demonstration of firewalls
Week 15	Defense against Control Hijacking-Platform Defenses, Defense against Control Hijacking-Runtime Defenses, Advanced Control Hijacking attacks	Demon-stration	Program using varions attacks

EXPERIMENTS:

1. Implementation of Ceaser cipher
2. Implementation of hill cipher
3. Implementation of play fair cipher
4. Implementation of DES algorithm
5. Implementation of RSA algorithm
6. Implementation of Diffie hellman key exchange algorithm
7. Implementation of AES algorithm
8. Implementation of firewall techniques
9. Implementation of email security
10. Implementation of IP security

TEXT BOOK(S):

1. M Stallings, Cryptography and Network Security Principles and Practice Seventh Edition, PHI, 2017.

REFERENCES:

1. Behrouz A. Ferouzan, Cryptography Network Security, Tata Mc Graw 2nd Edition,2010.
2. 2. Charles Pfleeger, Security in Computing, 5th Edition, Prentice Hall of India, 2015.

4.27 213CSE1305: PERVASIVE AND UBIQUITOUS COMPUTING

213CSE1305	PERVASIVE AND UBIQUITOUS COMPUTING	L	T	P	X	C
		3	0	2	0	4
Pre-requisite : Operating Systems **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the characteristics and principles of Pervasive computing
- To understand the various components that helps to build pervasive computing system
- To understand the necessity of sensor networks and RFID that capture and disseminate context information
- To understand the principles, challenges, infrastructures and user interface that supports the ubiquitous computing
- To design and implement Pervasive and Ubiquitous applications that are embedded in everyday objects

COURSE OUTCOMES:

CO1: Understand the enabling technologies that drive the pervasive and ubiquitous computing

CO2: Analyze and compare the performance of different data dissemination techniques

CO3: Formulate the design aspects, that are essential to create the model of pervasive computing

CO4: Develop solutions for problems related to pervasive and ubiquitous computing system through investigation

CO5: Analyze the various applications of Ubiquitous computing

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S	S	M	M		S	M	L	L				S	
CO3		S		M	S	S	M	L					S	
CO4		S	S	M	S	S	M	L	L				S	S
CO5				M		S	M	L					S	

UNIT I: Introduction

Pervasive Computing: Principles - Characteristics - interaction transparency - context aware – automated experience capture - Vision and challenges of pervasive computing - Pervasive computing infrastructure - Architecture for pervasive computing - Pervasive devices - embedded controls - smart sensors and actuators - Context communication and access services.

UNIT II: Technologies

Device Technology for Pervasive Computing: Hardware - Human-machine interfaces - Biometrics – Operating Systems - Java for pervasive devices - Voice Technology: Basics of Speech Recognition - Voice standards - Speech Applications - Speech and Pervasive Computing - Security - Personal Digital Assistants.

UNIT III: Sensor Networks and RFID

Introduction to Sensor networks: Sensor Node Architecture - Sensor Network Architecture - Types of sensor networks - Platforms for Wireless sensor networks - Applications of Wireless Sensor networks - Introduction to RFID - transponder and reader architecture - Types of tags and readers - Frequencies of operation - Application of RFID Technologies

UNIT IV: Introduction to Ubiquitous Computing

An introduction - overview - challenges to research topics in ubiquitous computing including sensors – ambient displays - tangibles - middleware - mobility - allocation and context awareness - Architecture for ubiquitous computing: new devices and communications - software architectures - Wireless standards protocols for ubiquitous networks - Near field communication (NFC) - Bluetooth classic - Bluetooth Low Energy (BLE) - WiFi- WiFi Direct.

UNIT V: Ubiquitous Computing Applications

Ubiquitous applications: the appropriate design - Weiser's vision of ubiquitous computing - mixed reality and sensible design - Wearable computing - Glass and Augmented Reality - Eye-Tracking-Digital Pen and Paper Mobile social networking crowd sensing Event based social network

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)	Pedagogy
Week 1	Pervasive Computing Principles,Characteristics,interaction transparency,context aware ,automated experience capture	Explicit Teaching	Hands-on session on Installing J2ME simulator	Demonstration

Week 2	Vision and challenges of pervasive computing ,Pervasive computing infrastructure, Architecture for pervasive computing	Explicit Teaching	Design the software using mobile phone using J2ME	Problem based learning
Week 3	Pervasive devices - embedded controls - smart sensors and actuators - Context communication and access services	Flipped Learning	Design a web application from PCs using smart card authentication	Problem based learning
Week 4	Device Technology for Pervasive Computing Hardware, Human-machine interfaces, Biometrics, Operating Systems	Explicit Teaching	Design a web application from PCs using smart card authentication	Problem based learning
Week 5	Java for pervasive devices,Voice Technology, Basics of Speech Recognition ,Voice standards, Speech Applications	Explicit Teaching	Create a web application via WAP phones	Problem based learning
Week 6	Speech and Pervasive Computing - Security - Personal Digital Assistants	Flipped Learning	Create a web application via WAP phones	Problem based learning
Week 7	Introduction to Sensor networks Sensor Node Architecture, Sensor Network Architecture, Types of sensor networks	Explicit Teaching	Create a Web application from PDAs	Problem based learning
Week 8	Platforms for Wireless sensor networks, Applications of Wireless Sensor networks, Introduction to RFID	Flipped Learning	Design the photo sharing application	Problem based learning
Week 9	Transponder and reader architecture,Types of tags and readers,Frequencies of operation,Application of RFID Technologies	Explicit Teaching	Design the photo sharing application	Problem based learning
Week 10	An introduction,overview,challenges to research topics in ubiquitous computing including sensors, ambient displays,tangibles, middleware,mobility,allocation and context awareness	Explicit Teaching	Basics of WSN programming using Tiny os	Problem based learning

Week 11	Architecture for ubiquitous computing new devices and communications, software architectures,Wireless standards	protocols for ubiquitous networks	Explicit Teaching	Hands on session of WSN programming using Tiny OS
Week 12	Near field communication (NFC), Bluetooth classic, Bluetooth Low Energy (BLE), WiFi- WiFi	Flipped Learning	simulation of WSN using TOSSIM framework	Demonstration
Week 13	Ubiquitous applications the appropriate design, Weiser's vision of ubiquitous computing, mixed reality and sensible design	Explicit Teaching	Interfacing RFID reader with computer using reader communication protocols	Problem based Learning
Week 14	Wearable computing - Glass and Augmented Reality	Flipped Learning	Reading a UID from the RFID tag using TAG commands and response	Problem based Learning
Week 15	Eye-Tracking-Digital Pen and Paper Mobile social networking and crowd sensing Event based social network	Explicit Teaching	Case study and projects	Project based Learning

EXPERIMENTS:

1. Design the software using mobile phone using J2ME
2. Design a web application from PCs using smart card authentication
3. Create a web application via WAP phones
4. Create a Web application from PDAs
5. Design the photo sharing application
6. Basics of WSN programming using Tiny os
7. Simulation of WSN using TOSSIM framework
8. Interfacing RFID reader with computer using reader communication protocols
9. Reading a UID from the RFID tag using TAG commands and response

TEXT BOOK(S):

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec, Klaus Rindtorff, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Sixth Edition, Pearson Education, New Delhi, 2009.
2. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Pub., Taylor and Francis Group, New York, 2007.
3. John Krumm, "Ubiquitous Computing Fundamentals", CRC Press, 2010.

REFERENCES:

1. Rahul Banerjee, "Lecture Notes in Pervasive Computing", Outline Notes, BITS-Pilani, 2012.
2. Genco, S. Sorce, "Pervasive Systems and Ubiquitous Computing", WIT Press, 2012.
3. Guruduth S. Banavar, Norman H. Cohen, Chandra Narayanaswami, "Pervasive Computing: An Application-Based Approach", Wiley Interscience, 2012.
4. Frank Adelstein, S K S Gupta, G G Richard, L Schwiebert, "Fundamentals of Mobile and Pervasive Computing", Tata McGraw Hill, New Delhi, 2005.
5. Stefen Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions", Second Edition, Wiley, 2010.

4.28 213CSE2311: VIRTUALIZATION

213CSE2311	VIRTUALIZATION	L	T	P	X	C
		3	0	2	0	4
Pre-requisite : Computer Networks **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

To make the students realize the need and benefits of virtualization and automation by introducing various types, architectures and implementation of virtualization.

COURSE OUTCOMES:

CO1: Justify the need and benefits of virtualization over the conventional methods.

CO2: Analyze various virtualization approaches.

CO3: Elaborate the concept and working mechanism of virtual machines.

CO4: Examine the data management of complex virtual environments using VM ware technology.

CO5: Compare performance factors of virtualized systems, principal issues in troubleshooting virtual environment.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S										M		S	
CO2	S											S	S	
CO3	S												S	
CO4	S	S	S	S	S	M	L						S	
CO5	S	S	S	S	S	M	L						S	

UNIT I: Introduction

Virtualization Overview - Benefits Need of Virtualization Limitations Traditional Vs Contemporary Virtualization Pitfalls of Virtualization Hypervisors Virtualization Considerations for Cloud Providers, Data Centre Architecture, Types of Components, Repository Architecture Style, Blackboard Architecture Style..

UNIT II: Types of Virtualization

Types of Hardware Virtualization: Full Virtualization Para Virtualization Desktop Virtualization Server Virtualization Data Virtualization OS Level Virtualization Application

Level Virtualization Comparing Virtualization Approaches Managing Heterogeneous Virtualization Environment Customized and Modifying Virtualization Advanced Virtualization Case Studies.

UNIT III: Virtual Machine

Understanding Virtual Machines Taxonomy of Virtual Machines Life Cycle Process and System Level Virtual Machines Emulation Binary Translation Techniques Managing Storage for Virtual Machine Applications of Virtual Machines.

UNIT IV: Implementation

Building and Managing Virtual Machine Xen Hypervisor And Its Architecture VMware VSphere Kernel Virtual Machine (KVM) Microsoft Hyper-V - Virtual Box, Virtual machine sprawling, Hypervisor vulnerabilities, Hypervisor attacks, VM attacks, VM migration attacks.

UNIT V: Automation and Management

Cloud Management Reference Architecture Data Center Challenges And Solutions Goals of Automating Virtualization Management Automating The Data Center Benefits Of Data Center Automation Virtualization For Automatic Service Provision Virtualization Management, Private cloud implementation using Eucalyptus, Hyper-V and VMWare.

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)
Week 1	Virtualization Overview - Benefits Need Of Virtualization Limitations Traditional Vs Contemporary	Explicit Teaching	Introduction to virtualization.
Week 2	Pitfalls of Virtualization Hypervisors Virtualization Considerations for Cloud Providers	Explicit Teaching and Demonstration	Virtual Machine Creation.
Week 3	Data Centre Architecture, Types of Components,Repository Architecture Style, Blackboard Architecture Style.	Demon-stration	Implemenation of various architecture.
Week 4	Types of Hardware Virtualization: Full Virtualization Para Virtualization Desktop Virtualization	Explicit Teaching	Installation of vCenter.
Week 5	Server Virtualization,Data Virtualization OS Level Virtualization Application Level Virtualization	Explicit Teaching and Demonstration	Implementation of different Virtualization

Week 6	Comparing Virtualization Approaches Managing Heterogeneous Virtualization,Environment Customized and Modifying Virtualization Advanced Virtualization Case Studies	Explicit Teaching	Analyzing the different Virtualization approaches
Week 7	Understanding Virtual Machines Taxonomy of Virtual Machines Life Cycle Process	Demon-stration	Working with automation tools: Puppet,chef
Week 8	System Level Virtual Machines Emulation Binary Translation Techniques	Explicit Teaching and Demonstration	Implementation of emulation binary translation
Week 9	Managing Storage for Virtual Machine Applications of Virtual Machines	Demon-stration	Working with automation tools: chef.
Week 10	Building and Managing Virtual Machine Xen Hypervisor And Its Architecture	Explicit Teaching and Demonstration	Implementation using Xen Hypervisor
Week 11	VMware VSphere Kernel Virtual Machine (KVM) Microsoft Hyper-V - Virtual Box	Explicit Teaching and Demonstration	Demonstration for Kernel Virtual Machine (KVM)
Week 12	Virtual machine sprawling, Hypervisor vulnerabilities, Hypervisor attacks, VM attacks, VM migration attacks	Explicit Teaching	Analyzing the different VM attacks
Week 13	Cloud Management Reference Architecture Data Center Challenges And Solutions Goals Of Automating Virtualization Management Automating	Explicit Teaching and Demonstration	Working with Microsoft Hyper-V.
Week 14	The Data Center Benefits Of Data Center Automation Virtualization For Automatic Service Provision	Demon-stration	Data centre Virtualization
Week 15	DVirtualization Management Private cloud implementation using Eucalyptus,Hyper-V and VMWare	Demon-stration	Implementation of private cloud using Eucalyptus

EXPERIMENTS:

1. Virtual Machine Creation
2. Installation of vCenter
3. Working with automation tools: Puppet, chef
4. Working with Microsoft Hyper-V
5. Demonstration for Kernel Virtual Machine
6. Analyzing the different VM attacks
7. Implementation using Xen Hypervisor
8. Implementation of emulation binary translation
9. Implementation of private cloud using Eucalyptus

TEXT BOOK(S):

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing principles and Pradigms, John Wiley Sons, 2011..

REFERENCES:

1. James E.Smith, Ravi Nair, Virtual Machines , Elsevier, 2005.
2. Charles Pfleeger, Security in Computing, 5th Edition, Prentice Hall of India, 2015.
3. Mathew Portney, Virtualization Essentials, John Wiley Sons, 2012.
4. Time Cerfing, Jeff Buller, Check Enstall, Richard Ruiz, Mastering Microsoft Virtualization, Wiley Publications, 2010.
5. Ventkata Josyula, Malcolm Orr, Greg Page, Cloud Computing: Automating the Virtualized Data Center, Cisco Press, 2012.
6. William Von Hagen, Professional Xen Virtualization, Wiley Publications, 2008.
7. Cody Bunch, Automating vSphere with VMware vCenter Orchestrator: Technology Hand-on, Pearson Education, 2012.

4.29 213CSE2312: MOBILE AND WIRELESS SECURITY

213CSE2312	MOBILE AND WIRELESS SECURITY	L	T	P	X	C
		3	0	2	0	4
Pre-requisite :COMPUTER NETWORK **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To provide a comprehensive overview of all relevant aspects of security in mobile and wireless networks and also to introduce to students advanced research topics.
- To provide possibilities for hands on experience with developing security features

COURSE OUTCOMES:

CO1: Understand the architecture and various attacks of mobile systems

CO2: Demonstrate the various attacks and security in wireless systems

CO3: Analyze the various security issues in different wireless networks

CO4: Analyze the various security models of mobile networks

CO5: Examine the various risks in different mobile devices and Apps

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S			M		S	M	L	L				S	
CO3		S		M	S	S	M	L				M	S	
CO4		S	S	M	S	S	M	L	L			M	S	
CO5				M		S	M	L			M	M	S	

UNIT I: INTRODUCTION

Mobile system architecture mobile cellular systems GSM and UMTS security attacks vulnerabilities in cellular services cellular jamming attacks and mitigation security in VoIP services

UNIT II: WIRELESS SECURITY

Introduction to wireless security, types of security attacks, security policies, Symmetric Encryption and Message Confidentiality, Public Key Cryptography, Managing security in wireless devices

UNIT III: WIRELESS NETWORK SECURITY

Overview of wireless networking, WLAN security models- Security in Wireless Cellular Networks, Security in Mobile Ad hoc and sensor Networks, Security in Software defined Networks

UNIT IV: MOBILE SECURITY

Introduction to Mobile Security, Building Blocks, Basic security and cryptographic techniques. Security of GSM Networks,Security of UMTS Networks,LTE Security, WiFi and Bluetooth Security, SIM/UICC Security ,Mobile Malware and App Security, Android Security Model, IOS Security Model,Security Model of the Windows Phone,SMS/MMS, Mobile Geolocation and Mobile Web Security, Security of Mobile VoIP Communications

UNIT V: MOBILE DEVICE SECURITY

Types of mobile devices, Comparison of different mobile platforms, Mobile hardware security, Mobile device risks Location tracking, Accessing Untrusted content, BYOD risks, securing mobile devices Device setup, Device and App Management, Mobile device App Security

15 WEEK COURSE PLAN

Week	Lecture (2 hours)	Pedagogy	Practical (2 hours)	Pedagogy
Week 1	Mobile system architecture mobile cellular systems GSM and UMTS	Explicit Teaching	Hands-on session on NS3	Demonstration
Week 2	security attacks vulnerabilities in cellular services	Explicit Teaching	Hands on session for basics of Network Simulation	Demonstration
Week 3	cellular jamming attacks and mitigation security in VoIP services	Flipped Learning	Hands on session for Evaluating the security related performance measures	Demonstration
Week 4	Introduction to wireless security, types of security attacks	Explicit Teaching	Implementation of Block hole attack	Problem based Learning
Week 5	security policies-Symmetric Encryption and Message Confidentiality	Flipped Learning	Implementation of Rushing attack	Project based Learning
Week 6	Public Key Cryptography- Managing security in wireless devices	Explicit Teaching	Implementation of RSA Algorithm	Problem based Learning

Week 7	Overview of wireless networking- WLAN security models	Flipped Learning	Implementaion of MD5 Algorithm	Problem based Learning
Week 8	Security in Wireless Cellular Networks – Security in Mobile Ad hoc Network	Explicit Teaching	Implementation of Denial of service attack	Project based Learning
Week 9	Security in Software defined Networks, Security in Wireless Sensor Networks	Explicit Teaching	Implementaion of Warmhole attack	Problem based Learning
Week 10	Introduction to Mobile Security -. Building Blocks – Basic security and cryptographic techniques. Security of GSM Networks- Security of UMTS Networks -. LTE Security . WiFi and Bluetooth Security	Explicit Teaching	IDemonstrate how to provide secure data storage, secure data transmission and for creating digital signatures	Demonstration
Week 11	SIM/UICC Security - . Mobile Malware and App Security - . Android Security Model 10. IOS Security Model -. Security Model of the Windows Phone	Flipped Learning	Develop an application that writes data to the SD card security	Problem based Learning
Week 12	SMS/MMS, Mobile Geolocation and Mobile Web Security. Security of Mobile VoIP Communications	Explicit Teaching	Develop a native application that uses GPS location information and convert into speech	Problem based Learning
Week 13	Types of mobile devices- Comparison of different mobile platforms- Mobile hardware security	Flipped Learning	Design a program for Capture image using built in camera and store it in database	Problem based Learning
Week 14	Mobile device risks: Location tracking, Accessing Untrusted content, BYOD risks- securing mobile devices	Explicit Teaching	Develop a banking application that registers the user by verifying OTP	Problem based Learning

Week 15	Device setup, Device and App Management, Mobile device App Security	Explicit Teaching	Design interactive online shopping security	Problem based Learning

EXPERIMENTS:

1. Simulation of black hole attack
2. Simulation of denial of service attack
3. Simulation of rushing attack
4. Simulation of wormhole attack
5. Creating and intrusion detection system for wireless environment
6. Creating a mobile device security environment
7. Develop a banking application that registers the user by verifying OTP.
8. Design interactive online shopping security
9. Design a program for Capture image using built in camera and store it in database.
10. Develop a native application that uses GPS location information and convert into speech
11. Develop an application that writes data to the SD card security

TEXT BOOK(S):

1. Wolfgang Osterhage, Wireless Security, CRC Press, Second Edition ,2018.
2. Hakima Chaouchi, Maryline Laurent-Maknavicius, Wireless and Mobile Networks Security, Wiley, 2010
3. Anand R Prasad,Seung woo-seo,Security in next generation mobile networks, River Publishers, Aalborg, 2011

4.30 213CSE3313: GRAPH THEORY AND ITS APPLICATIONS

213CSE3313	**GRAPH THEORY AND ITS APPLICATIONS**	**L**	**T**	**P**	**X**	**C**
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- Introduce the fundamental concepts in graph theory
- Train to use graphs as a modeling tool and solve non-trivial problems in computer science

COURSE OUTCOMES:

CO1: Understand the basic concepts of graphs such as walks, paths and cycles

CO2: Apply the structural properties of graphs and design graph algorithms for finding MST

CO3: Understanding of coloring techniques and knowledge of planarity of graphs

CO4: Reasonable know how of digraphs and ability to handle tournaments, critical paths, flows and related supply and demand problems

CO5: Analyze the various computational issues and knowledge about small world phenomenon

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S	S	S	S	S								S	
CO3	S	S	S	S	S						M	M	S	
CO4	S	S	S	S	S	M	L				M	M	S	
CO5	S	S	S	S	S	M	L				M	M	S	

UNIT I: Basic Concepts

Sets, Binary Relations and Graphs, Degree, Radius, Diameter and Eccentricity, Weighted Distance, Euler walks, Hamilton Cycles, Travelling Salesman Problem

UNIT II: Connectivity

Cut-points and Bridges, Blocks, connectivity, Characterizations of Trees, Spanning Trees, Minimal Spanning Trees

UNIT III: Colorings and Planarity

Vertex Colorings, Brook's Theorem, Counting Vertex Colorings, Edge Colorings, Class 2 Graphs, Representations and Crossings, Euler's Formula, Maps, Graphs, and Planarity

UNIT IV: Directed Graphs

Basic Ideas, Orientations and Tournaments, Directed Euler Walks, Activity Graphs, Critical path Analysis, Critical Paths under uncertainty, Transportation networks and flows, maximal flows, max flow-min-cut theorem, max-flow min-cut algorithm, supply and demand problems

UNIT V: Computational Considerations

Computation time, data structures, graph algorithms, intractability, functions on graphs, classes of graphs, small-world graphs

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Tutorial (1 hours)
Week 1	Sets, Binary Relations and Graphs, Degree	Explicit Teaching	Binary relations problems
Week 2	Radius, Diameter and Eccentricity, Weighted Distance	Flipped Learning	Weighted distance problems
Week 3	Euler walks, Hamilton Cycles, Travelling Salesman Problem	Explicit Teaching	Hamilton cycles problems
Week 4	Cut-points and Bridges	Explicit Teaching	Cutpoints problems
Week 5	Blocks, connectivity, Characterizations of Trees	Flipped Learning	Connectivity problems
Week 6	Spanning Trees, Minimal Spanning Trees	Explicit Teaching	Minimum Spanning tree problems
Week 7	Vertex Colorings, Brook's Theorem, Counting Vertex Colorings	Explicit Teaching	Vertex coloring problems
Week 8	Edge Colorings, Class 2 Graphs, Representations and Crossings	Flipped Learning	Edge coloring problems

Week 9	Euler's Formula, Maps, Graphs, and Planarity	Explicit Teaching	Maps
Week 10	Basic Ideas, Orientations and Tournaments, Directed Euler Walks, Activity Graphs	Explicit Teaching	Activity Graphs
Week 11	Critical path Analysis, Critical Paths under uncertainty, Transportation networks and flows, maximal flows	Explicit Teaching	Critical paths problems
Week 12	max flow-min-cut theorem, max-flow min-cut algorithm, supply and demand problems	Flipped Learning	Supply and demand problems
Week 13	Computation time, data structures	Explicit Teaching	Computation time
Week 14	Graph algorithms, intractability, functions on graphs	Flipped Learning	Graph algorithms
Week 15	Classes of graphs, small-world graphs	Explicit Teaching	Classes of graphs

TEXT BOOK(S):

1. W.D. Wallis, A Beginner's Guide to Graph Theory, Second Edition, Springer International Edition, 2007, First Indian Edition 2011. Chapters 1-4, 7-8, 11-15.

REFERENCES:

1. Clark J. and Holton D.A, A First Look at Graph Theory, Allied Publishers, 1995.
2. Mott J.L., Kandel A. and Baker T.P. Discrete Mathematics for Computer Scientists and Mathematicians , Prentice Hall of India, 1996.
3. Liu C.L., Elements of Discrete Mathematics, Mc Graw Hill, 1985.
4. Rosen K.H., Discrete Mathematics and Its Applications, Mc Graw Hill, 2007.
5. D.B.West, Introduction to Graph Theory, Prentice Hall of India, New Delhi, 2004.
6. J.A.Bondy and U.S.R Murty, Graph Theory, Springer, New York, 2008.
7. Santanu Saha Ray, Graph Theory with Algorithms and its Applications: In Applied Science and Technology Springer, 2013.

8. Jean-Claude Fournier, Graphs Theory and Applications: With Exercises and Problems John Wiley Sons.

9. Mamta Mittal, Graph Theory and Application, Anmol Publications Pvt. Ltd,2011.

10. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI Publisher, 2014.

11. Yellen J and Gross J, Graph Theory and its Applications, Chapman Hall, Boca Raton, 2006

12. Grimaldi R.P. Discrete and Combinatorial Mathematics: An Applied Introduction,Addison Wesley, 1994.

STREAM: ELECTRICAL AND ELECTRONICS COMMUNICATION

4.31 213CSE2313: EMBEDDED SYSTEMS

213CSE2313	EMBEDDED SYSTEMS	L	T	P	X	C
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To learn the architecture and programming of ARM processor.
- Understand the embedded computing platform design and analysis
- Get thorough knowledge in interfacing concepts and design an embedded system.

COURSE OUTCOMES:

CO1: Describe the architecture and programming of ARM processor.

CO2: Explain the concepts of embedded systems.

CO3: Understand the Concepts of peripherals and interfacing of sensors

CO4: Capable of using the system design techniques to develop firmware.

CO5: Illustrate the code for constructing a system.

CO6: Apply the concept of embedded System programming and explain the same experimentally following the ethical norms as an individual or a team and express the same in way of oral/written reports.
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MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S	S	S										S	
CO3	S		S				M				L		S	
CO4	S	S	S								L		S	
CO5	S					M					L		S	
CO6	S	S		M		S					S	M	S	

UNIT I:INTRODUCTION TO EMBEDDED SYSTEMS AND ARM PROCESSORS

Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II: EMBEDDED COMPUTING PLATFORM DESIGN

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III: SENSOR INTERFACING WITH ARDUINO

Basics of hardware design and functions of basic passive components-sensors and actuators- Arduino code - library file for sensor interfacing-construction of basic applications

UNIT IV: EMBEDDED FIRMWARE

Reset Circuit, Brown-out Protection Circuit-Oscillator Unit - Real Time Clock-Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

UNIT V:EMBEDDED C PROGRAMMING

Introduction-Creating 'hardware delays' using Timer 0 and Timer 1-Reading Switches- Adding Structure to the Code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)
Week 1	Complex systems and microprocessors	Explicit Teaching	Study of ARM evaluation system
	Embedded system design process	Explicit Teaching	Study of ARM evaluation system
	Design example: Model train controller	Demonstration	Study of ARM evaluation system
Week 2	Instruction sets preliminaries -	Explicit Teaching	Study of ARM evaluation system
	ARM Processor	Explicit Teaching	Study of ARM evaluation system

Week 3	CPU: programming input and output	Problem solving	Interfacing ADC and DAC.
	supervisor mode, exceptions and traps	Problem solving	Interfacing ADC and DAC.
	Co-processors- Memory system mechanisms	Explicit Teaching	Interfacing ADC and DAC.
	CPU performance- CPU power consumption.	Explicit Teaching	Interfacing ADC and DAC.
Week 4	The CPU Bus	Explicit Teaching	Interfacing EPROM and interrupt.
	Memory devices and systems	Explicit Teaching	Interfacing EPROM and interrupt.
	Designing with computing platforms	Explicit Teaching	Interfacing EPROM and interrupt.
	consumer electronics architecture	Explicit Teaching	Interfacing EPROM and interrupt.
Week 5	Platform-level performance analysis	Explicit Teaching	Interfacing keyboard
	Components for embedded programs	Explicit Teaching	Interfacing keyboard
	Models of programs	Explicit Teaching	Interfacing keyboard
	Assembly, linking and loading	Explicit Teaching	Interfacing keyboard
Week 6	The CPU Bus	Explicit Teaching	Interfacing EPROM and interrupt.
	Memory devices and systems	Explicit Teaching	Interfacing EPROM and interrupt.
	Designing with computing platforms	Explicit Teaching	Interfacing EPROM and interrupt.
	consumer electronics architecture	Explicit Teaching	Interfacing EPROM and interrupt.
Week 6	Compilation techniques	Explicit Teaching	Interfacing LCD.
	Program level performance analysis	Explicit Teaching	Interfacing LCD.
	Software performance optimization	Explicit Teaching	Interfacing LCD.
	Program level energy and power analysis and optimization	Explicit Teaching	Interfacing LCD.
	Analysis and optimization of program size	Explicit Teaching	Interfacing LCD.
	Program validation and testing	Explicit Teaching	Interfacing LCD.

Week 7	Basics of hardware design and functions of basic passive components	Explicit Teaching	Interfacing LED.
	Sensors and actuators	Explicit Teaching	Interfacing LED.
Week 8	Arduino code	Demonstration, Problem Solving	Interfacing stepper motor
	library file for sensor interfacing	Demonstration, Problem Solving	Interfacing stepper motor
Week 9	Arduino code	Demonstration, Problem Solving	Interfacing temperature sensor.
Week 10	Reset Circuit	Demonstration, Problem Solving	Interfacing serial port.
	Brown-out Protection Circuit-Oscillator Unit	Demonstration, problem solving	Interfacing serial port.
Week 11	Real Time Clock	Demonstration, Problem Solving	Interfacing real time clock
	Watchdog Timer	Demonstration	Interfacing real time clock
Week 12	Embedded Firmware Design Approaches and Development Languages	Explicit Teaching	Interrupt performance characteristics of ARM
Week 13	Introduction-Creating 'hardware delays' using Timer 0 and Timer 1	Demonstration, Problem Solving	Interrupt performance characteristics of FPGA.
	Reading switches	Demonstration, Problem Solving	Interrupt performance characteristics of FPGA.
	Adding Structure to the code	Demonstration, Problem Solving	Interrupt performance characteristics of FPGA.
	Generating a minimum and maximum delay	Demonstration, Problem Solving	Interrupt performance characteristics of FPGA.
Week 14	Example: Creating a portable hardware delay	Demonstration, Problem Solving	Flashing of LEDS.
	Timeout mechanisms	Demonstration, Problem Solving	Flashing of LEDS.

Week 15	Creating loop timeouts	Demonstration, Problem Solving	Interfacing seven segment LEDs
	Testing loop timeouts	Demonstration, Problem Solving	Interfacing seven segment LEDs
	Jardware timeouts	Demonstration, Problem Solving	Interfacing seven segment LEDs
	Testing a hardware timeout	Demonstration, Problem Solving	Interfacing seven segment LEDs

EXPERIMENTS:

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Interrupt performance characteristics of ARM and FPGA.
8. Flashing of LEDS.
9. Interfacing stepper motor and temperature sensor.

TEXT BOOK(S):

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition "Morgan Kaufmann Publisher, 2012.
2. Michael J. Pont, "Embedded C", 2nd Edition, Pearson Education, 2008.

REFERENCES:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill.2014
2. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", 3rd Edition, Cengage Learning, 2012
3. Raj Kamal, "Embedded Systems-Architecture, programming and design", 3rd Edition TMH.2015
4. David E. Simon, "An Embedded Software Primer", Pearson Education,2000.

4.32 213CSE2314: RFID AND ITS APPLICATIONS

213CSE2314	RFID and its Applications	L	T	P	X	C
		3	1	0	0	4
Pre-requisite :NIL **Course Category :**Program elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To introduce students to the principles and concepts on the emerging technology of Radio Frequency Identification (RFID) and to provide with the knowledge required for designing, developing, implementing and administering RFID-based business or industrial applications..

COURSE OUTCOMES:

CO1: Learn the basic components and applications of RFID systems.

CO2: Analyse and characterize RFID readers and Tags/

CO3: Analyse and appreciate various antennas used in RFID systems.

CO4: Analyse and characterize RFID protocols and Standards.

CO5: Analyse and characterize RFID security.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S												S	
CO3	S												S	
CO4	S	S	S	M	M								S	
CO5	S	S	S	S	S	S	M						S	

UNIT I: RFID Basics

History and Practice of RFID – RFID Systems and Terminology – Types of RFID – Frequency Bands for RFID – Tags-Passive, Semi passive, and Active Tags. Radio Basics for UHF RFID -Signal Voltage and Power – Information – Modulation, and Multiplexing – Backscatter Radio Links – Link Budgets – Effect of Antenna Gain and Polarization on Range – Propagation in the Real World.

UNIT II: RFID Readers and Tags

UHF RFID Readers: Radio Architectures and Components - RFID Transmitters and RFID Receivers - Digital-Analog Conversion and Signal Processing - Packaging and Power
UHF RFID Tags: Power and Powerlessness - RF to DC - Getting Data - Talking Back - Tag IC Overall Design Challenges - Packaging

UNIT III: RFID Antennas

Reader Antennas: Antennas for Fixed Readers – Antennas for Handheld or Portable Readers – Nearfield Antennas – Cables, and Connectors
Tag Antennas: Practical challenges of Tag antenna – Impedance Matching and Power Transfer – Dipoles and Derivatives – Tags and the (local) Environment – Near-field and Hybrid Tag Antennas

UNIT IV: RFID Protocols and Standards

EPC global Generation 1-EPC global Class 0, EPC global Class 1 Generation 1 – ISO 18000-6B (Intellitag), ISO 18000-6C (EPC global Class 1 Generation 2), RFID Standards, Laws, Regulations, Policies, and Guidelines

UNIT V: RFID Security and Applications

RFID Security: Confidentiality, Integrity, Availability, Threats, Cryptography, and Threat Modelling
RFID Applications: Aircraft Identification, Railcar Tracking, Automobile Tolling, Animal Tracking, Container Tracking, Supply Chain Tracking for Consumer Goods

15 WEEK COURSE PLAN

Weeks	Lecture (3 Hours)	Pedagogy
Week 1	History and Practice of RFID – RFID Systems and Terminology	Explicit Teaching
	Types of RFID – Frequency Bands for RFID	Explicit Teaching
	Tags-Passive, Semi passive, and Active Tags	Explicit Teaching
Week 2	Radio Basics for UHF RFID	Explicit Teaching
	Signal Voltage and Power	Explicit Teaching
	Information – Modulation, and Multiplexing	Explicit Teaching
Week 3	Backscatter Radio Links	Explicit Teaching
	Link Budgets	Explicit Teaching
	Effect of Antenna Gain and Polarization on Range	Explicit Teaching
	Propagation in the Real World	Explicit Teaching
Week 4	Radio Architectures	Explicit Teaching
	Radio Components – Amplifier – power, gain bandwidth, distortion, (concept only), noise (concept only), mixers (concept only)	Explicit Teaching

Weeks	Lecture (3 Hours)	Pedagogy
Week 5	conversion loss & Spurious Frequencies, Oscillator, filters, Digital Analog Conversion, Circulators and Directional Couplers (basic concepts only)	Explicit Teaching
Week 6	RFID Transmitters	Explicit Teaching
	Transmitter Architectures, Transmit Power Efficiency, Phase and Amplitude Noise (concepts only)	Explicit Teaching
Week 7	Receiver Architectures, Phase and Amplitude Noise and Sensitivity, Friis equation	Explicit Teaching
Week 8	Digital-Analog Conversion and Signal Processing, Packaging and power	Explicit Teaching
Week 9	UHF RFID Tags: Power and Powerlessness	Explicit Teaching
	RF to DC	Explicit Teaching
	Getting Data	Explicit Teaching
	Talking Back	Explicit Teaching
	Tag IC Overall Design Challenges	Explicit Teaching
	Packaging	Explicit Teaching
Week 10	Antennas for Fixed Readers	Explicit Teaching
	Antennas for Handheld or Portable Readers	Explicit Teaching
	Nearfield Antennas	Explicit Teaching
	Cables, and Connectors	Explicit Teaching
Week 11	Tag Antennas: Practical challenges of Tag antenna	Explicit Teaching
	Impedance Matching and Power Transfer	Explicit Teaching
Week 12	Dipoles and Derivatives	Explicit Teaching
	Tags and the (local) Environment	Explicit Teaching
	Near-field and Hybrid Tag Antennas	Explicit Teaching
Week 13	EPC global Generation 1-EPC global Class 0, EPC global Class 1 Generation 1	Explicit Teaching
	ISO 18000-6B (Intellitag), ISO 18000-6C (EPC global Class 1 Generation 2)	Explicit Teaching
Week 14	RFID Applications - Aircraft Identification, Railcar Tracking, Automobile Tolling, Animal Tracking, Container Tracking, Supply Chain Tracking for Consumer Goods	Explicit Teaching
Week 15	Things to Keep in Mind: Makers, Things to Keep in Mind: Users	Explicit Teaching

TEXT BOOK(S):

1. A1.Daniel M. Dobkin, The RF in RFID: UHF RFID in Practice, Elsevier/Newness, U.S./India, 2012(2nd Edition), ISBN: 9780123945839.

2. Jari-Pascal Curty, Michel Declercq, Catherine Dehollain, Norbert Joehl, Design and Optimization of Passive UHF RFID Systems, Springer, 2007, ISBN: 9780387352749

REFERENCES:

1. 1.Tom Igoe, Getting Started with RFID: MAKE-OBJECTS, OReilly/Make: makezine.com, 2012, ISBN: 9781449324186

2. Amin Rida, Li Yang, Manos M. Tentzeris, RFID-Enabled Sensor Design and Applications, Artech House, 2010, ISBN: 9781607839811

4.33 213CSE3314: COGNITIVE RADIO

213CSE3314	**Cognitive Radio**	**L** 3	**T** 1	**P** 0	**X** 0	**C** 4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- On completion of the course delegates will be able:
- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities, study the basic architecture and standard for cognitive radio, understand the physical, MAC and Network layer design of cognitive radio and to expose the student to evolving applications and advanced features of cognitive radio.

COURSE OUTCOMES:

CO1: Understand the principles of software defined radio and cognitive radio.

CO2: Relate hardware and software architecture of Cognitive radio

CO3: Analyse the user detection techniques and spectrum sensing in cognitive radio

CO4: Design the MAC and Network layer for Cognitive Radio.

CO5: Apply the knowledge of advanced features of cognitive radio for real world applications.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S												S	
CO3	S												S	
CO4	S	S	S	M	M								S	
CO5	S	S	S	S	S								S	

UNIT I: Introduction to Cognitive Radio

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT II: Cognitive Radio Architecture

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT III: Spectrum Sensing and Dynamic Spectrum Access

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

UNIT IV: MAC and Network Layer Design for Cognitive Radio

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT V: Advanced Topics in Cognitive Radio

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

15 WEEK COURSE PLAN

<table>
<tr><th>Week</th><th>Lecture (3 Hours)</th><th>Pedagogy</th></tr>
<tr><td rowspan="3">Week 1</td><td>Evolution of Software Defined Radio</td><td>Explicit Teaching</td></tr>
<tr><td>Cognitive radio: goals, benefits, definitions</td><td>Explicit Teaching</td></tr>
<tr><td>Architectures</td><td>Demonstration</td></tr>
<tr><td>Week 2</td><td>Relations with other radios,
issues,
enabling technologies</td><td>Explicit Teaching</td></tr>
<tr><td>Week 3</td><td>Radio frequency spectrum and regulations.</td><td>Explicit Teaching</td></tr>
<tr><td>Week 4</td><td>Cognition cycle – orient, plan, decide and act phases, Organization</td><td>Explicit Teaching</td></tr>
<tr><td rowspan="2">Week 5</td><td>SDR as a platform for Cognitive Radio</td><td rowspan="2">Explicit Teaching</td></tr>
<tr><td>Hardware and Software Architectures</td></tr>
<tr><td>Week 6</td><td>Overview of IEEE 802.22 standard for broadband wireless access in TV bands</td><td>Explicit Teaching</td></tr>
</table>

Week	Lecture (3 Hours)	Pedagogy
Week 7	Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches	Explicit Teaching
Week 8	Fundamental Trade-offs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access	Explicit Teaching
Week 9	Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.	Explicit Teaching
Week 10	MAC for cognitive radios – Polling, ALOHA, slotted ALOHA	Demonstration
Week 11	CSMA, CSMA / CA, Network layer design	Demonstration
Week 12	Routing in cognitive radios, flow control and error control techniques	Explicit Teaching
Week 13	Overview of security issues in cognitive radios	Explicit Teaching
Week 14	auction based spectrum markets in cognitive radio networks	Demonstration
Week 15	public safety and cognitive radio, cognitive radio for Internet of Things	Explicit Teaching

TEXT BOOK(S):

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, “Cognitive Radio Communications and Networks”, Academic Press, Elsevier, 2010.

2. Huseyin Arslan (Ed.), “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2014.

REFERENCES:

1. Bruce Fette, “Cognitive Radio Technology”, Newnes, 2006.

2. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive Radio Networks”, John Wiley and Sons, 2009. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, “Principles of Cognitive Radio”, Cambridge University Press, 2012.

4.34 213CSE3315: PRINCIPLES OF COMMUNICATION

213CSE3315	PRINCIPLES OF COMMUNICATION	L	T	P	X	C
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To study the techniques of analog modulation.
- Pulse modulation and digital modulation.
- The principles behind information theory.
- Coding and digital communication techniques.

COURSE OUTCOMES:

CO1: Understand the Analog modulation techniques

CO2: Understand the Pulse modulation techniques

CO3: Apply digital communication techniques

CO4: Analyse Source and Error control coding

CO5: Analyse the Multiple Access techniques

CO6: Apply the concept of analog and digital modulation techniques experimentally following the ethical norms as an individual or a team and express the same in way of oral/written reports
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MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S											S	S	
CO2	S	S	S	S	S							S	S	
CO3	S	S	S	S	S		M				L	S	S	
CO4	S	S	S	S	S						L	S	S	
CO5	S						M				L	S	S	
CO6	S	S		M		S					S	M	S	

UNIT I: ANALOG MODULATION

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers.

UNIT II: PULSE MODULATION

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM and ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing.

UNIT III: DIGITAL MODULATION AND TRANSMISSION

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-Array signalling, M-array PSK QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers.

UNIT IV: INFORMATION THEORY AND CODING

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

UNIT V: SPREAD SPECTRUM AND MULTIPLE ACCESS

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)
Week 1	Amplitude Modulation – AM, DSBSC, SSBSC, VSB	Explicit Teaching/ Demonstration	Amplitude Modulation techniques with DSBSC, SSBSC using MATLAB
Week 2	PSD, modulators and demodulators	Explicit Teaching/ Demonstration	Design of modulators and demodulators for Analog Modulation using SIMULINK
Week 3	Angle modulation – PM and FM PSD, modulators and demodulators	Explicit Teaching/ Demonstration	Design of modulators and demodulators for Phase Modulation using SIMULINK
	Superheterodyne receivers	Explicit Teaching/ Demonstration	Design of modulators and demodulators for Phase Modulation using SIMULINK
Week 4	Low pass sampling theorem – Quantization – PAM, PCM, DPCM	Explicit Teaching/ Demonstration	PAM, PCM and DPCM using MATLAB
Week 5	Line coding – DM, and ADPCM and ADM	Explicit Teaching/ Demonstration	DM and ADPCM using MATLAB
Week 6	Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing	Explicit Teaching/ Demonstration	TDM and FDM using SIMULINK
Week 7	Phase shift keying – BPSK, DPSK, QPSK	Explicit Teaching/ Demonstration	BPSK, DPSK, QPSK using MATLAB
Week 8	Principles of M-Array signalling, M-array PSK and QAM	Explicit Teaching/ Demonstration	M-ary Signalling, M-ary PSK and QAM using MATLAB
Week 9	Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers	Explicit Teaching/ Demonstration	Synthesis of Eye pattern using MATLAB
Week 10	Measure of information – Entropy	Explicit Teaching/ Demonstration	Fano coding, Huffman Coding and LZ coding using MATLAB

	Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding	Explicit Teaching/ Demonstration	Fano coding, Huffman Coding and LZ coding using MATLAB
Week 11	Channel capacity – Shannon-Hartley law – Shannon's limit	Explicit Teaching/ Demonstration	Cyclic codes using MATLAB
	Error control codes – Cyclic codes, Syndrome calculation	Explicit Teaching/ Demonstration	Cyclic codes using MATLAB
Week 12	Convolution Coding, Sequential and Viterbi decoding	Explicit Teaching/	Convolution coding using MATLAB
Week 13	PN sequences – properties – m-sequence – DSSS	Explicit Teaching/ Demonstration	Generation of PN sequences using MATLAB
Week 14	Processing gain, Jamming – FHSS – Synchronisation and tracking, Multiple Access	Explicit Teaching/	Multiple Access Techniques such as FDMA, TDMA using MATLAB
Week 15	FDMA, TDMA, CDMA	Explicit Teaching/ Demonstration	Multiple Access Techniques such as CDMA using MATLAB

EXPERIMENTS:

1. Amplitude Modulation techniques with DSBSC, SSBSC using MATLAB
2. Phase Modulations – FM, PM using MATLAB
3. PCM and DPCM
4. DM and ADPCM
5. Phase shift keying techniques
6. M-array PSK and QAM
7. Cyclic Codes
8. Convolution Coding
9. Multiple Access Techniques such as FDMA, TDMA and CDMA

TEXT BOOK(S):

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 3/e, TMH 2007
2. S. Haykin “Digital Communications” John Wiley 2005

REFERENCES:

1. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007.
2. H P Hsu, Schaum Outline Series “Analog and Digital Communications” TMH, 2006.
3. B.Sklar, Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007.

4.35 213CSE3316–SIGNAL AND IMAGE PROCESSING

213CSE3316	SIGNAL AND IMAGE PROCESSING	L	T	P	X	C
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the basics of signal systems.
- Analyse signals using Fourier and Wavelet Transforms.
- Study the digital image fundamentals.
- Get exposed to image enhancement techniques.
- To study the image segmentation and representation techniques.

COURSE OUTCOMES:

CO1: Understand different types of Signals and Systems

CO2: Understand the different transform techniques of signals

CO3: Analyse the various types of images and analyse them

CO4: Analyse the methodologies for image enhancement and restoration

CO5: Analyse the methodologies for image enhancement and restoration

CO6: Apply the concept of signal and image processing experimentally following the ethical norms as an individual or a team and express the same in way of oral/written reports.

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MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S												S	
CO2	S	S	S										S	
CO3	S		S				M				L		S	
CO4	S	S	S								L		S	
CO5	S					M					L		S	
CO6	S	S		M		S					S	M	S	

UNIT I: BASICS OF SIGNALS AND SYSTEMS

Definition of Signals and System, Classification of Signals and Systems, Signal Operations, Basic Signals, Two Dimensional and Three-Dimensional Signals.

UNIT II: TRANSFORMS AND ITS APPLICATIONS

Introduction to Fourier Transform and its Properties, Discrete Time Fourier Transform and its Properties, Fast Fourier Transform, Introduction to Wavelet Transform, types and its properties. Application of transforms in one dimensional signal processing

UNIT III: BASICS OF IMAGE PROCESSING

Introduction –Steps in Image Processing Systems – Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

UNIT IV: IMAGE ENHANCEMENT AND RESTORATION

Spatial Domain Image Enhancement- Point Processing, Histogram, Histogram Equalization. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering. Introduction to Image Restoration – Noise Models

UNIT V: IMAGE SEGMENTATION AND ANALYSIS

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques. Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)

Week 1	Definition of Signals and System	Explicit Teaching/ Demonstration	Generation of Continuous and Discrete Time Unit Impulse, Unit Step and Unit Ramp Signals, Rectangular, Triangular and Exponential Signals in MATLAB
	Classification of Signals and Systems	Explicit Teaching/ Demonstration	Generation of Continuous and Discrete Time Unit Impulse, Unit Step and Unit Ramp Signals, Rectangular, Triangular and Exponential Signals in MATLAB
	Properties of LTI System	Explicit Teaching/ Demonstration	Generation of Signum Function, Sinusoidal Signals using MATLAB
Week 2	Signal Operations	Explicit Teaching/ Demonstration	Addition, Subtraction and Multiplication of Signals using MATLAB
	Convolution	Explicit Teaching/ Demonstration	Time Scaling, Time Shifting, Amplitude Scaling and Time Reversal on Signals using MATLAB Convolution of two signals using MATLAB
Week 3	Basic Signals	Explicit Teaching/ Demonstration	Generation of two dimensional signals using MATLAB
	Two Dimensional and Three-Dimensional Signals	Explicit Teaching/ Demonstration	Generation of two dimensional signals using MATLAB
Week 4	Introduction to Fourier Transform and its Properties	Explicit Teaching/ Demonstration	Signal Transformation using Fourier Transform using MATLAB
	Discrete Time Fourier Transform and its Properties	Explicit Teaching/ Demonstration	Signal Transformation using Continuous Fourier Transform using MATLAB
Week 5	Fast Fourier Transform	Explicit Teaching/ Demonstration	Fast Fourier Transform using MATLAB

	Introduction to Wavelet Transform, types and its properties	Explicit Teaching/ Demonstration	Signal Transformation using Wavelet Transform in MATLAB
Week 6	Application of transforms in one dimensional signal processing	Explicit Teaching/ Demonstration	Analysis of one dimensional signals using Transforms in MATLAB
Week 7	Introduction. Steps in Image Processing Systems, Image Acquisition, Sampling and Quantization – Pixel Relationships	Explicit Teaching/ Demonstration	Image sampling and Quantization
Week 8	File Formats – colour images and models	Explicit Teaching/ Demonstration	Image conversion from RGB to Greyscale conversion and Gray scale to Binary using MATLAB
Week 9	Image Operations – Arithmetic, logical, statistical and spatial operations	Explicit Teaching/ Demonstration	Fast Fourier Transform using MATLAB
Week 10	Spatial Domain Image Enhancement- Point Processing	Explicit Teaching/ Demonstration	Image Enhancement in Spatial Domain
	Histogram, Histogram Equalization	Explicit Teaching/ Demonstration	Image Enhancement in Spatial Domain
Week 11	Filtering in Frequency Domain, Smoothing and Sharpening filters	Explicit Teaching/ Demonstration	Image Enhancement in Frequency Domain
Week 12	Homomorphic Filtering. Introduction to Image Restoration – Noise Models	Explicit Teaching/	Image Enhancement in Frequency Domain
Week 13	Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding	Explicit Teaching/ Demonstration	Region Based Image Segmentation using MATLAB
Week 14	Region Based Segmentation – Motion Segmentation Features – Textures - Boundary representations and Descriptions- Component Labeling	Explicit Teaching/ Demonstration	Boundary Based Image Segmentation using MATLAB

Week 15	Regional descriptors and Feature Selection Techniques. Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification	Explicit Teaching/ Demonstration	Feature Extraction and Classification using MATLAB

EXPERIMENTS:

1. Generation of Basic Signals using MATLAB / PYTHON
2. Operations on Basic Signals using MATLAB / PYTHON
3. Signal Transformation using Fourier transforms
4. Signal Transformation using Wavelet Transforms
5. RGB to Greyscale conversion
6. Greyscale to Binary Conversion
7. Image Enhancement in Frequency Domain
8. Image Enhancement in Spatial Domain
9. Region Based and Boundary Based Image Segmentation
10. Feature Extraction and Classification

TEXT BOOK(S):

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2015.(Unit I-II)
2. Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing’, Pearson, Third Edition, 2010. (Unit III-V)

REFERENCES:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.
4. Anil K. Jain, ‘Fundamentals of Digital Image Processing’, Pearson, 2002.

STREAM: SOFTWARE DEVELOPMENT

4.36 213CSE1306: WEB TECHNOLOGY

213CSE1306	WEB TECHNOLOGY	L 3	T 0	P 2	X 0	C 4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To make students to familiar with client server architecture and able to develop a web application using various technologies.
- To assist students to gain skills and project-based experience needed for entry into web application development careers.
- To learn the various installation procedure for embedding
- To design an interactive web site with various controls

COURSE OUTCOMES:

CO1: Interpret the technologies in web development

CO2: Develop programs using various scripting languages

CO3: Create an interactive web application using user interfaces

CO4: Understand the basics of server side scripting and learn the web server installation procedure

CO5: Analyze various database connectives and create an interactive web application

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M		L		L		S	S		L	M	S	
CO2	S	S	S	S	S	M	S			M	M	M	S	
CO3	S	S	S	S	S	M	L	L	L	L	L	L	S	
CO4	S	S	S	S	S	M	M		M			S	S	
CO5	S	S	S	S	S	S	M	M	M	S	L	S	S	

UNIT I INTRODUCTION TO WEB TECHNOLOGIES

Evolution of the Internet and World Wide Web–Web Basics -Client-Side Scripting versus Server-Side Scripting-World Wide Web Consortium (W3C) -Web 2.0-Introduction to HTML5- Editing HTML5- Validation Service- Headings - Linking - Images -alt Attribute-Void Elements-Using Images as Hyperlinks - Special Characters and Horizontal Rules - Lists - Tables - Forms- Internal Linking - meta Elements - New HTML5 Form input Types- Page-Structure Elements -ARIA- attributes and roles - SEO techniques.

UNIT II CSS AND SCRIPTING LANGUAGES

Introduction to Cascading Style Sheets- Inline Styles - Embedded Style Sheets - Conflicting Styles - Linking External Style Sheets - Positioning Elements-Backgrounds Element Dimensions -Box Model and Text Flow Media Types and Media Queries - Drop-Down Menus -User Style Sheets- JavaScript: Introduction to Scripting- Displaying a Line of Text with JavaScript in a Web Page -Modifying Your First Script -Obtaining User Input with prompt Dialogs-Dynamic Welcome Page - Adding Integers-Memory Concepts-Arithmetic -Decision Making: Equality and Relational Operators, Control Statements ,functions, arrays.

UNIT III XML AND INTERNET APPLICATION

XML -Introduction -XML Basics - Structuring Data -XML Namespaces-Document Type Definitions (DTDs)-W3C XML Schema Documents-XML Vocabularies-Ajax-Enabled Rich Internet Applications with XML and JSON-Introduction History of Ajax- “Raw” Ajax Example Using the XMLHttpRequest Object - Asynchronous Requests-Exception Handling -Callback Functions -XMLHttpRequest Object Event, Properties and Methods-Using XML and the DOM- Creating a Full-Scale Ajax-Enabled Application-AJAX serverset - Using JSON- Rich Functionality - Interacting with a Web Service on the Server-Parsing JSON Data

UNIT IV WEB SERVERS WEB DATABASES

Introduction -HTTP Transactions-Multitier Application -architecture - Client-Side Scripting versus Server-Side Scripting Accessing Web Servers - Apache, MySQL and PHP Installation XAMPP Installation ,running ,testing procedures, Microsoft IIS Express and Web Matrix - Installing, running ,client side, PHP examples- -MySQL –mock databases - Microsoft Language Integrate Query - Java DB/Apache Derby – Introduction of - REST APIs

UNIT V WEB APPLICATION DEVELOPMENT

Introduction -Your First ASP.NET Application in C and Visual basic-Building the Web-Time Application-Standard Web Controls: Designing a Form Validation Controls- Session Tracking-Web Services-Case Study: Database-Driven ASP.NET Guestbook, Case Study:

Password-Protected Books Database Application– React - supporting interact with react – dynamic react mock-ups -React Hooks- SCRATCH Frame work

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical(2 hours)
Week 1	TEvolution of the Internet and World Wide Web-Web Basics -Client-Side Scripting	Explicit Teaching	Using HTML5 canvas with JavaScript to draw lines, rectangles, arcs, and circles
Week 2	Introduction to HTML5-Editing HTML5- Validation Service- Headings - Linking - Images-alt Attribute- Void Elements-Using Images as Hyperlinks	Explicit Teaching	Using HTML5 to create a animated house using various controls
Week 3	Special Characters and Horizontal Rules -Lists - Tables - Forms- Internal Linking - meta Elements - New HTML5 Form input Types and Examples -Page-Structure Elements	Explicit Teaching	Use HTML to create a interactive Website with course registration form
Week 4	Embedded Style Sheets - Conflicting Styles -Linking External Style Sheets - Positioning Elements-Backgrounds Element Dimensions	Explicit Teaching	Using HTML5 canvas with JavaScript to draw gradients and shadows
Week 5	Box Model and Text Flow Media Types and Media Queries - Drop-Down Menus -User Style Sheets - JavaScript: Introduction to Scripting- Displaying a Line of Text with JavaScript in a Web Page	Explicit Teaching	Create a Time table for entire class
Week 6	Modifying Your First Script -Obtaining User Input with prompt Dialogs-Dynamic Welcome Page - Adding Integers-Memory Concepts-Arithmetic - Decision Making: Equality and Relational Operators	Explicit Teaching	Create a animated images with all controls

Week 7	Control Statements ,functions, arrays,XML -Introduction -XML Basics -Structuring Data -XML Namespaces-Document Type Definitions (DTDs)-W3C	Explicit Teaching	Design a scientific calculator
Week 8	XML Schema Documents-XML Vocabularies-Ajax-Enabled Rich Internet Applications with XML -JSON-Introduction History of Ajax- "Raw" Ajax Example Using the XMLHttpRequest	Explicit Teaching	Write an XML file and DTD file which will display the Book information
Week 9	Object - Asynchronous Requests-Exception Handling -Callback Functions XMLHttpRequest Object Event, Properties and Methods- Using XML and the DOM	Explicit Teaching	Usage of JavaScript function JSON.parse(text) which converts a JSON text into a JavaScript object.
Week 10	Creating a Full-Scale Ajax-Enabled Application- Using JSON- Rich Functionality -Interacting with a Web Service on the Server- Parsing JSON Data -Introduction -HTTP Transactions	Explicit Teaching	Create a E- regsitration using Ajax applications
Week 11	Introduction -HTTP Transactions-Multitier Application - Server-Side Scripting Accessing Web Servers -Apache, MySQL	Explicit Teaching	Procedure to use JSON to read data from a web server, and display it in a web page using XMLHttp
Week 12	PHP Installation XAMPP Installation ,running ,Express and WebMatrix - testing procedures, Microsoft IIS - Installing, running ,client side, PHP examples	Explicit Teaching	Installation and Configuration of APACHE

Week 13	Introduction to Relational Databases-MySQL -Microsoft Language Integrate Query -Java DB/Apache Derby - Introduction -Your First ASP.NET Application in C	Explicit Teaching	Installation and Configuration of WAMP stack,ASP.NET
Week 14	Visual basic-Building the Web Time Application-Standard Web Controls	Explicit Teaching	Using JSON , HTML and XML to design a home automation system
Week 15	Designing a Form Validation Controls- Session Tracking	Explicit Teaching	Using JSON , HTML and XML to design a shopping management system

EXPERIMENTS:

1. Using HTML5 canvas with JavaScript to draw lines, rectangles, arcs, and circles.
2. Using HTML5 canvas with JavaScript to draw gradients and shadows.
3. Write an XML file and DTD file which will display the Book information
4. Installation Configuration of APACHE,WAMP stack
5. Procedure to use and configure Php MyAdmin to manage mySQL databases.
6. Create a Ajax-Enabled Rich Application with PHP and mySQL for course registration form
7. Design a web page for online cultural fest with interactive manner
8. Usage of JavaScript function JSON.parse(text) which converts a JSON text into a JavaScript object.
9. Procedure to use JSON to read data from a web server, and display it in a web page using XMLHttp.
10. Using JSON , HTML and XML to design a home automation system
11. Design a single page app using scratch from client side, backend and DB access
12. Design a app using open source DBs like MongoDB, MySQL.

TEXT BOOK(S):

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet World Wide Web How to Program, 5/e, Pearson Education Asia, 2009

REFERENCES:

1. Eric Ladd, Jim O' Donnel, "Java, XHTML, HTML, XML: magnum", Prentice Hall of India, QUE, 2000.

2. Rajkamal, "Web Technology", Tata McGraw-Hill, 2007, 7th edition.

3. Jon Duckett,"Web Design with HTML, CSS, JavaScript and jQuery Set" Wiley, First edition, 2014

4.37 213CSE2315: SOFTWARE TESTING

213CSE2315	**SOFTWARE TESTING**	**L**	**T**	**P**	**X**	**C**
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To understand the basic knowledge in software development organization
- To know the various types of software testing for any real time project
- To analyse the importance of testing in various levels
- To learn the various test models and methods for validation
- To utilize various tools for validation

COURSE OUTCOMES:

CO1: Understand the basics of software testing and testing levels

CO2: Design and apply various software test process for a software testing project

CO3: Develop a test tool and able to categorise the software test automation

CO4: Ability to understand the various software testing problems, selecting software test models and methods

CO5: Analyze various communication methods and skills for various practice-oriented software testing projects

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		M		S		L		S	S		L		S	
CO2	M		L				S			M	M	M	S	
CO3	M	L	S		M	M		L			L	L	S	
CO4	L			M		M		M			S	S	S	
CO5	S	L	L	L	L	S	M	M	M	S	L	S	S	

UNIT I: INTRODUCTION

Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process –Basic Definitions – Software Testing Principles – The Tester‘s Role in a Software development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository

UNIT II TEST CASE DESIGN

Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Requirements based testing – positive and negative testing - Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing– cause-effect graphing – error guessing - compatibility testing – user documentation testing – domain testing Using White–Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing - Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria.

UNIT - III LEVELS OF TESTING

The Need for Levels of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests. The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing -Integration Tests – Integration Test Planning – scenario testing – defect bash elimination -System Testing – types of system testing - Acceptance testing – performance testing – Regression Testing – internationalization testing – ad-hoc testing - Alpha – Beta Tests – testing OO systems – usability and accessibility testing

UNIT IV – TEST MANAGEMENT

People and organizational issues in testing – organization structures for testing teams – testing services - Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process - Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group

UNIT V - TEST AUTOMATION

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Measurements and milestones for controlling and monitoring – status meeting- reports and control issues – criteria for test completion – SCM – Review program – Types of review- Components of review plan – reporting review result – cucumber tool – selenium tool - working principles

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical(2 hours)
Week 1	Testing as an Engineering Activity ,Role of Process in Software Quality,Testing as a Process –Basic Definitions,Software Testing Principles	Explicit Teaching	Study of Selenium web testing tool
Week 2	The Tester‘s Role in a Software development Organization,Origins of Defects – Defect Classes,The Defect Repository and Test Design	Explicit Teaching	Write and test a program to login a specific web page.
Week 3	Defect Examples,Developer/Tester Support for Developing a Defect Repositor, Using Black Box Approach to Test Case Design Random Testing	Explicit Teaching	Write and test a program to select the number of students who have scored more than 60 in any one subject
Week 4	Requirements based testing – positive and negative testing – Boundary Value Analysis – decision tables -Equivalence Class Partitioning state-based testing cause	Explicit Teaching	Create and Develop the test cases for banking application
Week 5	effect graphing – error guessing - compatibility testing – user documentation testing ,domain testing Using White–Box Approach to Test design – Test Adequacy Criteria	Explicit Teaching	Write all test cases for banking

Week 6	static testing vs. structural testing -code functional testing -Coverage and Control Flow Graphs – Covering Code Logic – Paths -Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria	Explicit Teaching	Design a Control flow for real time application
Week 7	The Need for Levels of Testing – Unit Test – Unit Test Planning -Designing the Unit Tests. The Test Harness – Running the Unit tests and Recording results	Explicit Teaching	Create a test plan document for Library Management System application
Week 8	Integration tests – Designing Integration Tests – Integration Test Planning - scenario testing – defect bash elimination -System Testing – types of system testing - Acceptance testing	Explicit Teaching	Categorize the levels of testing with various tests for real time problem
Week 9	performance testing – Regression Testing – internationalization testing – adhoc testing - Alpha -Beta Tests – testing OO systems – usability and accessibility testing	Explicit Teaching	Develop and design a real time testing scenario and categorize the levels of testing
Week 10	People and organizational issues in testing – organization structures for testing teams – testing services - Test Planning – Test Plan Components -Test Plan Attachments – Locating Test Items – test management	Explicit Teaching	Test plan creation for various real time application with schedule, report

Week 11	test process - Reporting Test Results -The role of three groups in Test Planning and Policy Development - Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group	Explicit Teaching	Learn Cucumber tool for testing
Week 12	Software test automation – skills needed for automation – scope of automation-design and architecture for automation – requirements for a test tool	Explicit Teaching	Project team formation- design , scope and requirement
Week 13	challenges in automation – Measurements and milestones for controlling and monitoring -status meeting-reports and control issues – criteria for test completion	Explicit Teaching	Real time website automation using selenium
Week 14	SCM – Review program – Types of review- Components of review plan	Explicit Teaching	Apply selenium tool for online trading websites and validate the report
Week 15	reporting review result – cucumber tool – selenium tool - working principles	Explicit Teaching	Apply cucumber tool for online trading websites and validate the report

EXPERIMENTS:

1. Study of Selenium web testing tool
2. Using Selenium IDE, Write a test suite containing minimum 4 test cases.
3. Write and test a program to login a specific web page.
4. Write and test a program to select the number of students who have scored more than 60 in any one subject
5. Write the test cases for banking application
6. Create a test plan document for Library Management System application
7. Create a test plan document for online shopping and validate the same using cucumber

8. Apply selenium tool for zomato website and prepare the test plan ‘
9. Apply selenium and cucumber tool for online trading websites and validate the report

TEXT BOOK(S):

1. Ilene Burnstein,"Practical Software Testing",6th Edition, Springer International Edition Aditya P.Mathur, ?Foundations of Software Testing?, Pearson Education, 2014.
2. Srinivasan Desikan and Gopalaswamy Ramesh, " Software Testing – Principles and Practices", Pearson education, 2010

REFERENCES:

1. Boris Beizer, Software Testing Techniques, Second Edition, Dreamtech, 2013
2. Elfriede Dustin, Effective Software Testing?, First Edition, Pearson Education, 2010.
3. Renu Rajani, Pradeep Oak, Software Testing Effective Methods, Tools and Techniques?, Tata McGraw Hill, 2010

4.38 213CSE2316: MOBILE APPLICATION DEVELOPMENT

213CSE2316	MOBILE APPLICATION DEVELOPMENT	L	T	P	X	C
		3	0	2	0	4

Pre-requisite :NIL
Course Category : Program Elective
Course Type : Integrated Course - Theory

COURSE OBJECTIVES:

- To provide a basic idea on MOBILE APPLICATION DEVELOPMENT
- To explore the techniques by solving problems of student interest.
- To make students to learn application development and develop mobile app on various mobile platform like ANDROID and IOS.
- To provide security in developed mobile app.

COURSE OUTCOMES:

CO1: Understand about the mobile application market and web services for various mobile devices.

CO2: Understand about the various Mobile Information Design, design Tools, Mobile Platforms and Mobile Web Option.

CO3: Create the User interface with various features of Android SDK like displaying pictures, menus etc.

CO4: Evaluate the networking and location-based service in Android application

CO5: Apply security in mobile developed app

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M							L		M		S	
CO2	S			M				M		L	S		S	
CO3				S	S	M	L		L		S		S	
CO4	S	S	M			M	L	L	M				S	
CO5		S			M	S	L		S	M	M	S	S	

UNIT I: INTRODUCTION

Preliminary Considerations Cost of Development Importance of Mobile Strategies in Business World Mobile Web Presence Mobile Applications Marketing Web Services for Mobile Devices Creating Example Web Service Debugging Web Service

UNIT II:MOBILE USER INTERFACE DESIGN

Effective Use of Screen Real Estate Understanding Mobile Application Users Understanding Mobile Information Design Understanding Mobile Platforms Using the Tools for Mobile Interface Design Choosing a Mobile Web Option Adaptive Mobile Website Dedicated mobile website Mobile Web Applications with HTML 5

UNIT III: ANDROID APPLICATION DEVELOPMENT

Getting started with Android Designing Your User interface using Views Displaying Pictures and Menus with Views Using Image views to Display pictures Using menus with views Data Persistence Saving and loading user performances - Persisting data to files Creating and using Data bases Content Providers.

UNIT IV: ANDROID MESSAGING, NETWORKING, LOCATION BASED SERVICES

SMS Messaging, Sending E-mail Networking Downloading Binary Data, Text Files-Accessing Web Services Performing Asynchronous Calls Location Based Services Displaying Maps Getting Location Data Creating your own services Communicating between a service and an activity Binding activities to Services

UNIT V: SECURITY IN MOBILE APPLICATIONS

Introduction to secure mobile application development, methods of protecting sensitive data on mobile devices, Introduction to Android Security, iOS Security and Windows Security.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)	Pedagogy
Week 1	Importance of Mobile Strategies in Business World.Mobile Applications Marketing .Web Services for Mobile Devices Creating Example	Explicit teaching	Design elements and principles.Android application design and development basics	Demonstration
Week 2	Debugging in Web Service.Effective Use of Screen Real Estate Understanding Mobile Application.Users Understanding Mobile Information Design	Explicit teaching drill and practice	Designing simple applications to convert celsius to fahrenheit	Problem based learning

Week 3	Understanding Mobile Platforms Using the Tools for Mobile Interface Design.Choosing a Mobile Web Option Adaptive Mobile Website	Explicit Teaching	Designing android application to create alarm clock	Problem based learning
Week 4	Dedicated mobile website Mobile Web Applications with HTML 5.	drill and practice	Designing interactive android application to perform simple calculator	Problem based learning
Week 5	Getting started with Android Designing Your User interface using Views.	drill and practice	Designing interactive android application to perform simple calculator	Problem based learning
Week 6	Using menus with views Data Persistence Saving and loading user performances	Explicit Teaching	Designing android application to create an employee database.	Demonstration
Week 7	Persisting data to files Creating and using Data bases Content Providers	drill and practice	Designing android application to create an employee database	Problem based learning
Week 8	SMS Messaging, Sending E-mail Networking Downloading Binary Data	Explicit teaching	Design android application to create a notification upon receiving a message	Problem based learning
Week 9	Text Files-Accessing Web Services. Performing Asynchronous Calls Location Based Services	Explicit Teaching	Designing android application to locate your service using GPS	Problem based learning
Week 10	Displaying Maps Getting Location Data Creating your own services	drill and practice	Designing android application to locate your service using GPS	Problem based learning
Week 11	Communicating between a service and an activity Binding activities to Services	compare and contrast	Create an android application using SD card as the storage component	Independent study
Week 12	Introduction to secure mobile application development	Explicit teaching	Design interactive online shopping securly	Independent study
Week 13	Methods of protecting sensitive data on mobile devices	Explicit teaching	Develope an application that writes data to the SD card securly	Problem based learning

Week 14	Introduction to Android Security.iOS Security and Windows Security.	Explicit Teaching	Building Your First iOS 13 App,Learn how Xcode functions. How to build an iOS application structure.Create a full-fledged iOS application	Demonstration,Problem based learning

EXPERIMENTS:

1. Create an android application to change the font shape and color
2. Create an android application to scroll
3. Create an android application to convert Celsius to Fahrenheit
4. Create an android application to show image transition using image view
5. Create an android application to create alarm clock
6. Create an android application to perform a simple calculator
7. Create an android application to create a notification upon receiving a message
8. Create an android application to create an employee database
9. Create an android application to locate your service using GPS
10. Create an android application using SD card as the storage component

TEXT BOOK(S):

1. 1. Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wrox 2012.
2. 2. Wei-Meng Lee Beginning Android 4 Application Development March 2012

REFERENCES:

1. 1. Charlie Collins, Michael Galpin and Matthias Kappler, Android in Practice, Dream Tech. 2012
2. 2. James Dovey and Ash Furrow, Beginning Objective C, Apress, 2012
3. 3. David Mark, Jack Nutting, Jeff LaMouche, and Fredric Olsson, Beginning iOS6 Development: Exploring the iOS SDK, Apress, 2013.
4. Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, “Programming PHP”, O’Reilly Media, 2012.

4.39 213CSE3317: FREE AND OPEN SOURCE SOFTWARE

		L	T	P	X	C
213CSE3317	**FREE AND OPEN SOURCE SOFTWARE**	3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To provide a basic idea of Open source technology, their software development process.
- • To understand the role and future of open source software in the industry along with the impact of legal, economic and social issues for such software.

COURSE OUTCOMES:

CO1: Understand the fundamentals of open source and the basic concepts of LINUX.

CO2: Create a query to work with open source database.

CO3: Analyse the fundamentals concepts of RUBY ON RAILS.

CO4: Create web application on IBM BLUMIX

CO5: Evaluate web services and open source tool by using case study

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M		L		S	M			S				S	
CO2	S	M	S			M	L				M		S	
CO3	L			S	L	L		S	M	L		M	S	
CO4		L	M	L	S	M	S		M		S	M	S	
CO5		S			M	S	L		S	M	M	S	S	

UNIT I: INTRODUCTION

Introduction to open sources- Need of Open Sources- Advantages of Open Sources- Applications of Open Sources- commercial aspects of Open source movement- LINUX: Introduction- General overview- Kernel mode and user mode-Process-Advanced Concepts- Scheduling-Personalities- Cloning- Signals-Development with LINUX.

UNIT II:OPEN SOURCE DATABASE

MySQL: Introduction- Setting up account-Starting, terminating and writing your own SQL programs Record selection technology- Working with strings-Date and Time- Sorting Query Results- Generating Summary- Working with meta data- Using sequences- MySQL and Web.

UNIT III: RUBY ON RAILS

Introduction- The Structure and Execution of Ruby Programs- Datatypes and Objects - Expressions and Operators - Statements and Control Structures - Methods, Procs, Lambdas, and Closures - Classes and Modules The Ruby Platform - The Ruby Environment.

UNIT IV: IBM BLUMIX

BLUMIX: Introduction-Evolution of BlueMix how does work-infrastructure storage network security Paas on the BlueMix - DBaas on the BlueMix - Web application on BlueMix mobile application on BlueMix - javasript and java application on BlueMix.

UNIT V: SECURITY IN WEB APPLICATIONS

Recognizing web application security threats, Code Grinder, Building functional and secure web applications, Security problems with Javascript, vulnerable GCI scripts, Code Auditing and Reverse Engineering, types of security used in applications.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)	Pedagogy
Week 1	Introduction to open sources,Need of Open Sources.Advantages of Open Sources, Applications of Open Sources.Commercial aspects of Open source movement	Explicit teaching	Basic Linux Commands And Package Management System.Virtualization Environment	Demonstration
Week 2	LINUX: Introduction-General overview-Kernel mode and user mode-Process.Advanced Concepts, Scheduling, Personalities, Cloning, Signals, Development with LINUX	Explicit teaching drill and practice	Linux Installation.Kernel Configuration, Compilation And Installation	Demonstration

Week 3	MySQL: Introduction- Setting up account-Starting, terminating and writing your own SQL programs Record selection technology.Working with strings, Date and Time- Sorting Query Results	Explicit Teaching,drill and practice	MYSQL INSTALLATION.Simple programs on MYSQL	Problem based learning
Week 4	Generating Summary-Working with meta data- Using sequences- MySQL and Web.	drill and practice	Retrieving data from web and storing it in database	Problem based learning
Week 5	RUBY ON RAILS: Introduction- The Structure and Execution of Ruby Programs	Explicit teaching	Basic about RUBY	Problem based learning
Week 6	Data types and Objects, Expressions and Operators, Statements and Control Structures, Methods, Procs, Lambdas, and Closures	Explicit Teaching	Simple programs on RUBY Ruby program to print Hello World!, Ruby program to add two integer numbers.	Demonstration
Week 7	Classes and Modules The Ruby Platform, The Ruby Environment.	drill and practice	Ruby on Rails: File uploading and send mails	Problem based learning
Week 8	BLUMIX: Introduction- Evolution of BlueMix how does work	Explicit teaching	Basics about BLUMIX	Problem based learning
Week 9	Infrastructure storage network security Paas on the BlueMix, DBaas on the BlueMix.Web application on BlueMix mobile application on BlueMix	Explicit Teaching	Mini Project using IBM Blumix.Version Control system setup and usage	Problem based learning
Week 10	Javasript and java application on BlueMix.	drill and practice	Working with Eclipse IDE	Demonstration

Week 11	Recognizing web application security threats, Code Grinder	Explicit teaching	Web Scrapping	Independent study
Week 12	Building functional and secure web applications, Security problems with Javascript.	Explicit teaching	Web page authentication using javascript	Independent study
Week 13	Vulnerable GCI scripts, Code Auditing and Reverse Engineering	Explicit teaching	GUI programming using Qt Menus and Toolbars.	Problem based learning
Week 14	Types of security used in applications.	Explicit Teaching	Case study on different web security tools	Demonstration

EXPERIMENTS:

1. LINUX INSTALLATION
2. MYSQL INSTALLATION
3. 1.RUBY Ruby program to print Hello World!, 2.Ruby program to add two integer numbers.
4. 1.Ruby program to find the area of the rectangle. 2.Ruby program to check leap year.
5. 1.Ruby program to print power of a number. 2.Ruby program to print Fibonacci series.
6. Ruby on Rails: File uploading and send mails.
7. Version Control system setup and usage.
8. Working with Eclipse IDE.
9. Mini Project using IBM Blumix

TEXT BOOK(S):

1. Introduction to Linux: Installation and Programming NRCFOSS Series, edited by N.B.Venkateswarlu, 2010
2. Robert Sheldon and Geoff Moes, Beginning MySQL , Wiley India, 2009.
3. David Flanagan, Yukihiro Matsumoto The Ruby Programming Language O'Reilly Media, 2010.
4. Christopher Negus, Linux Bible,Wiley Publishing Inc, Indianapolis, 2011.

5. IBM Bluemix Architecture Series: Web Application Hosting on IBM Containers, IBM Redbooks.

REFERENCES:

1. Sreetha sankaranarayanan Learning IBM BluMix, October 2016

2. Adam McDaniel, Perl and Apache: Your visual blueprint for developing dynamic Web content, Wiley Publishing Inc, Indianapolis, 2010.

3. Dave.W.Mercer, Allan Kent, Steve D Nowicki, Dan squire and Wankyu choi, Beginning PHP 5 , Wiley India,2010.

4. Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, “Programming PHP”, O’Reilly Media, 2012.

5. Michael Cross, “Developer’s Guide to Web Application Security”, Syngress Publishers, 2007.

4.40 213CSE3318: USER INTERFACE DESIGN

213CSE3318	**USER INTERFACE DESIGN**	**L**	**T**	**P**	**X**	**C**
		3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To Understand the importance of user interface process
- Able to create a new website with various GUI icons and styles
- To learn the importance of mobile interface and its usability to the user
- Design a User interface with web application frameworks

COURSE OUTCOMES:

CO1: Understand the importance of User Interface and learn the basic principle of UI design

CO2: Analyze various tools kits with object oriented approaches

CO3: Analyze the importance of various models, viewpoint of user, customer and designer

CO4: Create and develop and web interface design for real time applications

CO5: Design mobile application framework for mobile interface

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		M		S		L		S	S		L		S	
CO2	M		L				S			M	M	M	S	
CO3	M	L	S		M	M		L			L	L	S	
CO4	L			M		M		M			S	S	S	
CO5	S	L	L	L	L	S	M	M	M	S	L	S	S	

UNIT I HUMAN FACTORS AND USER INTERFACE DESIGN PROCESS

The importance of User Interface – UI and Software Designer – Goals of UI design – Motivations for human factors in Design – Understanding user needs and requirements. Classes of UI design – Principles of good design – Evaluating design using the principles – Choice of color – Task oriented approach for UI - Case study.

UNIT II OBJECT ORIENTED UI DESIGN

Design of icons – Use of metaphors – GUI style guides and toolkits – Portability – GUI design and object oriented approach – CSCW characteristics – Examples – CSCW UI – Method of specifying and designing UI for CSCW Case study

UNIT III USABILITY AND MODELS

The viewpoint of user, customer and designer –Usability specification – Description of stages in usability specification and evaluation. - Mobile Design: Elements of Mobile Design, Tools

UNIT IV WEB INTERFACE DESIGN

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. Designing Web Interfaces –Drag and drop, direct selection, contextual tools, overlays and virtual pages, process flow, case studies

UNIT V MOBILE UI

Mobile ecosystem: platforms and application frameworks: Types of mobile applications: widgets, applications, information architecture, Mobile 2.0, Mobile design – Goals of Mobile UX User centred approach to mobile design - power of mobile computing - case studies

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical(2 hours)

Week 1	The importance of User Interface – UI and Software Designer,Goals of UI design – Motivations for human factors in Design - Understanding user needs and requirements	Explicit Teaching	Web page design & development (scripting)
Week 2	Classes of UI design - Principles of good design - Evaluating design using the principles - Choice of color – Task oriented approach for UI - Case study	Explicit Teaching	Designing UI for mobile applications
Week 3	Design of icons – Use of metaphors -GUI style guides and toolkits – Portability -GUI design and object oriented approach	Explicit Teaching	Creating prototype of UI
Week 4	CSCW characteristics – Examples	Explicit Teaching	Designing interactive Web applications for student course registration
Week 5	CSCW UI – Method of specifying and designing -UI for CSCW Case study	Explicit Teaching	Designing interactive Web applications for student result management
Week 6	USABILITY AND MODELS-The viewpoint of user, customer and designer -Usability specification	Explicit Teaching	GUI for applications
Week 7	Description of stages in usability specification and evaluation	Explicit Teaching	Artificial Intelligence in developing UI
Week 8	Mobile Design: Elements of Mobile Design, Tools	Explicit Teaching	Design a scientific calculator
Week 9	Interactive Design: Basics – process - scenarios – navigation – screen design	Explicit Teaching	Design a interarive tic tac game
Week 10	Iteration and prototyping. Designing Web Interfaces - Drag and drop, direct selection, contextual tools, overlays	Explicit Teaching	Create a simple mobile apps with various interfaces
Week 11	virtual pages, process flow, case studies	Explicit Teaching	Create a mobile app for medical assistance

Week 12	Mobile ecosystem: platforms and application frameworks -Types of mobile applications	Explicit Teaching	Create a mobile app for blood bank management
Week 13	widgets, applications, information architecture, Mobile 2.0-	Explicit Teaching	Design interactive web application for online shopping
Week 14	Mobile design – Mobile Design	Explicit Teaching	Design an interative mobile apps for a course
Week 15	Goals of Mobile UX User centred approach to mobile design - power of mobile computing	Explicit Teaching	Design an interactive mobile apps using UX for real time applications

EXPERIMENTS:

1. Design elements and principles
2. Web page design development (scripting)
3. Designing UI for mobile applications
4. Creating prototype of UI
5. Designing interactive Web applications for student course registration
6. GUI for applications
7. Artificial Intelligence in developing UI
8. Design a scientific calculator
9. Create a mobile app for medical assistance
10. Design interactive web application for online shopping

TEXT BOOK(S):

1. Bill Scott and Theresa Neil, "designing Web Interfaces", O'Reilly, USA, 2011
2. Brian Fling," Mobile Design and Development", O'Reilly, USA, 2010

REFERENCES:

1. Alan Dix Janet Finlay, Gregory Abowd, Russell Beale, "Human - Computer Interaction", Prentice Hall, USA, 2010.
2. Andrew Sears, Julie A Kacko, ''The HCI handbook" , Lawrence Earlbaum Associates, New York, 2009.

4.41 213CSE3319: AGILE METHODOLOGY

		L	T	P	X	C
213CSE3319	**AGILE METHODOLOGY**	3	0	2	0	4
Pre-requisite :NIL **Course Category :**Program Elective **Course Type :**Integrated Course - Theory						

COURSE OBJECTIVES:

- To impart a thorough understanding of the principles and practices used in agile software development
- To explore these techniques by solving problems of student interest.
- To design and build simple Graphical Representation

COURSE OUTCOMES:

CO1: Understand the basic concepts of Agile Software Process.

CO2: Analyze the significance of Agile Methodology in software development.

CO3: Analyze the process of Agile Methodology.

CO4: Understand Agile Practicing and Testing

CO5: Apply the concepts of Agile Methodology using SCRUM Tools.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M		S		M				S				S	
CO2		S	L	M			S				M		S	
CO3	S			S	S	M		L				M	S	
CO4		M	M		L		M	S		M			S	
CO5	S	S		L	S	S	M		S	L	S	M	S	

UNIT I: INTRODUCTION

Software is new product development Iterative development Risk-Driven and Client-Driven iterative planning Time boxed iterative development During the iteration, No changes from external stakeholders Evolutionary and adaptive development - Evolutionary requirements analysis Early Top Ten high-level requirements and skillful analysis Evolutionary and adaptive planning Incremental delivery Evolutionary delivery The most common mistake Specific iterative and Evolutionary methods.

UNIT II:AGILE AND ITS SIGNIFICANCE

Agile development Classification of methods The agile manifesto and principles Agile project management Embrace communication and feedback Simple practices and project tools Empirical Vs defined and prescriptive process Principle-based versus Rule-Based Sustainable discipline: The Human touch Team as a complex adaptive system Agile hype Specific agile methods.

UNIT III: AGILE METHODOLOGY

Method overview Lifecycle Work products, Roles and Practices values Common mistakes and misunderstandings Sample projects Process mixtures Adoption strategies Fact versus fantasy Strengths versus Other history.

UNIT IV: AGILE PRACTICING AND TESTING

Project management Environment Requirements Test The agile alliances The manifesto Supporting the values Agile testing Nine principles and six concrete practices for testing on agile teams.

UNIT V: AGILITY AND QUALITY ASSURANCE

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy	Practical (2 hours)	Pedagogy
Week 1	Software is new product development Iterative development Risk-Driven and Client- Driven iterative planning Time boxed iterative development During the iteration	Explicit Teaching	Understand the background and driving forces for taking an Agile Approach to Software Development.	Demonstration
Week 2	No changes from external stakeholders Evolutionary and adaptive development Evolution- ary requirements analysis	drill and practice	Understand the business value of adopting agile approach.	Demonstration

Week 3	Early Top Ten high-level requirements and skilful analysis Evolutionary and adaptive planning Incremental delivery. Evolutionary delivery The most common mistake Specific iterative and Evolutionary methods.	Explicit Teaching	Understand agile development practices. Drive Development with Unit Test using Test Driven Development.	Problem based learning
Week 4	Agile development Classification of methods. The agile manifesto and principles Agile project management	Explicit Teaching	Apply Design principle and Refactoring to achieve agility	Problem based learning
Week 5	Embrace communication and feedback Simple practices and project tools.Empirical Vs defined and prescriptive process Principle-based versus Rule-Based	drill and practice	To study automated build tool.	Demonstration
Week 6	Sustainable discipline: The Human touch Team as a complex adaptive system Agile hype Specific agile methods.Method overview Life-cycle Work products, Roles and Practices values Common mistakes and misunderstandings	Explicit Teaching	To study version control tool.	Problem based learning
Week 7	Sample projects Process mixtures Adoption strategies	Explicit Teaching	To study Continuous Integration tool.	Problem based learning
Week 8	Fact versus fantasy Strengths versus Other history.Project management Environment Requirements Test	drill and practice	Perform Testing activities within an agile project.	Problem based learning

Week 9	The agile alliances The manifesto Supporting the values Agile testing. Nine principles and six concrete practices for testing on agile teams.	Explicit Teaching	Effective Practices and Federal Challenges in Applying Agile Methods	Problem based learning
Week 10	Agile Product Development	drill and practice	Distributed Scrum Project for Dutch Railways	Demonstration
Week 11	Agile Metrics	drill and practice	Distributed Scrum Project for Dutch Railways	Demonstration
Week 12	Feature Driven Development (FDD)	drill and practice	Owning the Sky with Agile	Demonstration
Week 13	Financial and Production Metrics in FDD	drill and practice	Owning the Sky with Agile	Demonstration
Week 14	Agile Approach to Quality Assurance – Test Driven Development	Explicit Teaching	Rolling Out Agile in a Large Enterprise	Demonstration
Week 15	Agile Approach in Global Software Development.	drill and practice	A CIO's Playbook for Adopting the Scrum Method of Achieving Software Agility:	Problem based learning

EXPERIMENTS:

1. Understand the background and driving forces for taking an Agile Approach to Software Development.
2. Understand the business value of adopting agile approach.
3. Understand agile development practices
4. Drive Development with Unit Test using Test Driven Development.
5. Apply Design principle and Refactoring to achieve agility
6. To study automated build tool.
7. To study version control tool.
8. To study Continuous Integration tool.
9. Perform Testing activities within an agile project.
10. A CIO's Playbook for Adopting the Scrum Method of Achieving Software Agility:

11. Distributed Scrum Project for Dutch Railways
12. Effective Practices and Federal Challenges in Applying Agile Methods:

TEXT BOOK(S):

1. Craig Larman, Agile and Iterative Development A Managers Guide, Pearson Education 2010.
2. Elisabeth Hendrickson Quality Tree Software Inc, Agile Testing 2010.
3. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
4. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

REFERENCES:

1. John Hunt, Agile Software Construction, Springer, USA, 2005.
2. Robert Martin, "Agile Software Development: Principles, Patterns, and Practices" Prentice Hall, USA, 2003.
3. Ken Schwaber and Mike Beedle, "Agile Software Development with SCRUM, Prentice Hall, USA, 2002.
4. Alistair Cockburn, Agile Software Development: The Cooperative Game, Pearson Education, 2007.
5. Kent Beck, Cynthia Andreas, Extreme Programming Explained: Embrace Change, Pearson Education, 2005.

5 EXPERIENTIAL ELECTIVE

5.1 216CSE4301: APPLICATIONS OF MACHINE LEARNING IN INDUSTRIES

216CSE4301	APPLICATIONS OF MACHINE LEARNING IN INDUSTRIES	L	T	P	X	C
		0	0	4	0	2
Pre-requisite :NIL **Course Category :**Experiential Elective **Course Type :**Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Applying Machine Learning in Financial Applications.
CO2: Applying Machine Learning in Entertainment, Communication and Life Sciences.
CO3: Applying Machine Learning in Education and Industries.
CO4: Applying Machine Learning in Government Sectors and Insurance.
CO5: Applying Machine Learing in Supply chain, Energy and Utilities.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	S	M	S	M				L	L	L		S	
CO2	S	S	S	S	S	M	S	M	M	M	L		S	
CO3	S	M	S	S	M	M		M	M	L			S	
CO4	S	M	M	M	M	M			L	L			S	
CO5	M	S	S	S	S		S		L	M	S	M	S	

UNIT I: A Brief Introduction to Machine Learning, Machine Learning in Banking and Securities Paradigms, Knowledge Representation, Data Acquisition, Data Pre-Processing, Feature Extraction and Processing, Feature Ranking and Selection, Feature Reduction, Model Learning, Evaluation and Deployment, Introduction- Analytics and Machine Learning Applications in Banking and Securities, Fraud Detection, Effective Application Screening, More Customer Acquisition and Retention, Better Knowledge of Customer Buying Habits, Efficient Cross-Selling, Improved Collections, Marketing Optimization, Increased Customer Lifetime Value, Effective Feedback Management.

UNIT II: Machine Learning in Communication, Media and Entertainment, Healthcare and Life Sciences Introduction - Change in Landscape with the Advent of Smartphone and Social Media, The Benefactors of Big Data in Media and Entertainment Industry - Video Publishers, Media Owners, Gaming Companies, Television Channels, Analytics and Machine Learning Applications in Communication, Media and

Entertainment Industries, Prediction of Audience Interests, Deriving Insights into Customer Churn, Optimizing Media Program Schedules, Content Monetization, Effective Targeting of Advertisements, Introduction - An Overview of Provider, Payer and Life Sciences Analytics, Business Value of Health Analytics - Value Life Cycle, Healthcare Analytics Framework- Key Drivers, Security, Privacy, and Risk Analytics in Healthcare, Meaningful Use and Role of Analytics - Complying with Regulatory Imperatives, Measuring the Impact of Social Media in Healthcare.

UNIT III: Machine Learning in Education, Manufacturing and Petroleum Industries Introduction, Current Challenges in the Education Sector - Multiple Modes of Education, Rapidly Changing Education Trends, Targeting the Right Population, Curbing the Dropout Rate, Planning and Budgeting for Sustainable Expansion, Effective Development of Instructor and Curriculum, The Consequences of these Challenges - High Dropout Rate, Higher Debt Pressure on Dropouts, Increasing Loan Defaults, Failure of the Education System, Universities Lose Revenues, How Analytics Can Help? - What-if Scenarios Creation for Planning, Budgeting and Forecasting, Analytics for Educators, Analytics for Pupils, Smart Governance and Management of Education Programs, Career Prediction and Assisting Students in Choosing their Career Paths, Introduction - Analytics and Machine Learning Approaches in Optimizing Production and Process Efficiency, Optimizing Product Quality, Robust Risk Management, Enhancing Warranty Planning, Improving Demand Planning and Inventory Management, Increasing Maintenance Efficiency, Analytics Applications in Petroleum Industry – Introduction, Upstream Analytics in Petroleum Industry - Exploration and Production Optimization, Oilfield Production Forecasting, Predicting Failure of Field Assets, Reservoir Characterization, Analytics for Unconventional Resource Recovery, Integrated Planning Capabilities, Downstream Analytics in Petroleum Industry - Demand Forecasting for Refining, Facility Integrity and Reliability, Commodity Trading Risk Management, Customer Intelligence .

UNIT IV: Machine Learning in Government and Insurance Introduction- Machine Learning and Analytics for Government - An Overview, Emerging Technologies for the Public Sector - Preparing for Big Data, Innovative Use Cases, Government Applications of the Internet of Things - Smart Cities, Motivations and Challenges for Government Use of the Internet of Things, Government Sponsored Healthcare and Life Sciences Projects - Genomics, Neuroscience, Government Use of Big Data for Cyber security - Illustrative Cyber security Solutions, Illustrative Case Studies - Dubai's Smart City Initiative, San Diego Supercomputer Center, National Center for Supercomputing Applications, Translational Genomics Research Institute, The Food and Drug Administration (FDA)'s Initiative to Detect and Study Patterns of Food Related Illness and Diseases, Introduction - Insurance Industry Overview, Emerging Trends - New Product Guidelines, Standard Proposal Forms and Need-Based Sales, Multi Tie-up for Banks, Role of Machine Learning in Insurance, Sales and Channel Management - Channel Strategy Optimization, Sales Reporting, Channel Management, Channel Analysis, Channel Profitability, Operations Management - New Business Processing, New Business Leakages, Customer Retention/Persistency, Attrition Analysis, Predicting Customer Behavior - Social Media Analytics, Use of GPS-Enabled Devices and CCTV Footage, Claims Management - Claims Payment Management, Claims Analysis, Marketing Management in Insurance Industry - Customer Segmentation, Product Management, Campaign Analysis, Profitability Management in Insurance Industry - Premium Analysis, Financial Analysis, Product Profitability Analysis, Underwriting Loss Analysis, Risk Management in Insurance - Reinsurance, Underwriting .

UNIT V:Machine Learning in Retail, Supply Chain, Transportation and Logistics, Energy and Utilities Introduction - Merchandising Analysis - Assortment Planning, Product Placement, Space Allocation, Product Adjacency, Market Basket Analysis, Marketing Analytics - Promotions, Pricing, Personalization, Campaigns, Store Operations Analytics - Workforce Effectiveness, Shrinkage, Inventory, Store Performance, Supply Chain Analytics - Logistics, Inventory, Supplier Performance, Demand Forecasting, Bull-Whip Effect, Introduction - Applications for Government - Traffic Control, Route Planning, Intelligent Transport Systems, Congestion Management, Applications for Private Sector - Revenue Management, Technological Enhancements, Logistics and for Competitive Advantage by Consolidating Shipments and Optimizing Freight Movement, Applications for Individuals - Route Planning for Saving Fuel and Time, Travel Arrangements in Tourism, Introduction - Smart Grids, Demand Response, Revenue Management, Fraud and Loss Prevention, Energy Efficiency, Compliance, Asset Maintenance and Management, Customer Care and Management, Forecasting and Load Management.

TEXT BOOK(S):

1. Application of machine learning in industries (IBM ICE Publications)

5.2 216CSE4302: BA FOR INDUSTRIES

216CSE4302	**BA FOR INDUSTRIES**	**L** 0	**T** 0	**P** 4	**X** 0	**C** 2
Pre-requisite :NIL **Course Category :**Experiential Elective **Course Type :**Integrated Course - Theory						

Course Objectives:

- Understand basics of analytics,
- Identify Apply of Business Analytics Solutions against common Business scenarios/problems/issues in Banking Arena,
- Identify Apply of Business Analytics Solutions against common Business scenarios/problems/issues in Insurance Arena,
- Identify Apply of Business Analytics Solutions against common Business scenarios/problems/issues in Telecom Arena &
- Understand and position key BA healthcare industry plays.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the role of analytics in business optimization.
CO2: Understand the basic elements of User cases for a clear understanding of business analytics.
CO3: Apply Business Analytics for Banking Case Studies (IBM Customer References), Replicate/Apply/Develop Business Analytics Solutions for other banks, estimation models.
CO4: Apply Business Analytics for Insurance Case Studies (IBM Customer References), Replicate/Apply/Develop Business Analytics Solutions for other Insurance Cos.
CO5: Apply Business Analytics for Telecom Case Studies (IBM Customer References), Replicate/Apply/Develop Business Analytics Solutions for other Telecom Cos Key differentiators within the context of critical healthcare industry pain points.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			S		S		S		M	L		S	
CO2	M				M		L	S	M			M	S	
CO3	L		L			S	S	S	S		L	M	S	
CO4	S	S		M	L	S	M	S	L			M	S	
CO5	S	M		M		S		S		S			S	

UNIT I: Introduction to Business Analytics Basics of analytics, Role of analytics in business optimization, The advantages of optimization, Reference architecture, use of reference architecture in business analytics, user cases for understanding business analytics.

UNIT II: Business Analytics for the Banking Industry The application of Business Analytics Solutions against common Business, scenarios/problems/issues in Banking Arena, business Analytics for Banking Case Studies (IBM Customer References), the process of developing Business Analytics Solutions for other banks.

UNIT III: Business Analytics for the Insurance Industry The application of business analytics solutions against common Business, scenarios/problems/issues in the Insurance Arena, Business Analytics for Insurance Case Studies (IBM Customer References), the process of developing Business Analytics Solutions for other Insurance Companies

UNIT IV: Business Analytics for the Telecom Industry The application of business analytics solutions against common Business, scenarios/problems/issues in the Telecom Arena, Business Analytics for Telecom Case Studies (IBM Customer References), the process of developing Business Analytics Solutions for other Telecom Companies.

UNIT V: Business Analytics for Healthcare The key healthcare trends business challenges, key BA value propositions to healthcare industry pain points, the key healthcare industry play assets, the key differentiators within the context of critical healthcare industry pain points.

TEXT BOOK(S):

1. BA for Industries (IBM ICE Publications)

5.3 216CSE4303: IOT FOR INDUSTRIES (Use Case Scenarios)

216CSE4303	IOT FOR INDUSTRIES (Use Case Scenarios)	L	T	P	X	C
		0	0	4	0	2
Pre-requisite :NIL **Course Category :**Experiential Elective **Course Type :**Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the woring principle of smarter wearables.
CO2: Analyse and design a suitable solution for employee safety and fire detector.
CO3: Analyse and design a suitable solution for healthcare sector.
CO4: Analyse and design a suitable solution for automative sector.
CO5: Analyse and design a suitable solution for retail and logistics sector.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	M										M	S	
CO2	M	M	S	S	S	S	M					M	S	
CO3	M	M	S	S	S	S	S	M	S	L	M	M	S	
CO4	M	M	S	S	S	S	M	M	S	L	M	M	S	
CO5	M	M	S	S	S	S	M	M	S	L	M	M	S	

UNIT I: Entertainment Wearables Entertainment- Bluetooth Headset, Fitness, Smart Watch, location and Tracking – Personal navigation Device

UNIT II: Manufacturing Flow Optimization- Flow Transmitter, Real Time Inventory – EPOS,ECR and Cash Drawer, Asset Tracking Process Analytics(pH, Gas, Concentration, Force Humidity)- portable data terminal, Employee safety – Fire and safety detector, Predictive Maintenance, Firmware Updates.

UNIT III: Healthcare Remote Monitoring-ECG, Ambulance Telemetry, Drug Tracking, Hospital Asset Tracking, Access Control, Predictive Maintenance.

UNIT IV: Automotive Infotainment, Wire replacement, Telemetry, Predictive maintenance, Car –to-car and Car-to-infrastructures, logistics Supply chain.

UNIT V: Retail and Logistics Supply chain control, NFC Payment, Intelligent shopping application, Smart product management, Green Houses, Golf courses, Meteorological station network, Compost, Wine quality enhancing, Quality of shipment conditions, Item Location, Storage In compatibility detection, Fleet tracking

TEXT BOOK(S):

1. IoT for Industries (IBM ICE Publications)

5.4 216CSE4304: INFORMATION SECURITY GOVERNANCE, MANAGEMENT PRACTICES, SECURITY AUDIT & MONITORING

216CSE4304	INFORMATION SECURITY GOVERNANCE, MANAGEMENT PRACTICES, SECURITY AUDIT & MONITORING	L	T	P	X	C
		0	0	4	0	2
Pre-requisite :NIL **Course Category :**Experiential Elective **Course Type :**Integrated Course - Theory						

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the information security goverence plocies in various levels of organization.
CO2: Apply the practical security measures for compiling the security using control frameworks.
CO3: Understand the various security plans,skills and role to ensure the information securuty for the computing environment.
CO4: Apply the different techniques for providing the security analysis, design and risk management.
CO5: Analyze the various security solutions to the Security implementation and review process.
CO6: Develop the security control framework by considereing the practical security constraints.
CO7: Implement the various methods for evaluating event analysis and response framework.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M	L									M	S	
CO2	S	S	S								M	S	S	
CO3	S	L	L									M	S	
CO4	S	M	S								M	S	S	
CO5	S	S	M									M	S	
CO6	S	S	M	S	L	L	M	M	M	L	L	S	S	
CO7	S	S	M	S	L	L	L	M	S	L	L	S	S	

UNIT I: Getting Information Security Right: Top to Bottom Overview, Information Security Governance, Tone at the Top, Tone at the Bottom, Governance, Risk, and Compliance (GRC), The Compliance Dilemma, Overview, Evolution of Information

Security, Organization Historical Perspective, Understand the External Environment, The Internal Company Culture, Prior Security Incidents, Audits , Security Strategy Development Techniques, Security Planning, History of the Security Leadership Role Is Relevant, The New Security Officer, Mandate, Security Leader Titles, Techie versus Leader, The Security Leaders Library, Security Leadership Defined, Security Leader Soft Skills, Seven Competencies for Effective Security Leadership, Security Functions, Reporting Model, Overview, Communication between the CEO, CIO, Other Executives, and CISO, Building Grassroots Support through an Information Security Council, Overview, Risk in Our Daily Lives, Accepting Organizational Risk, Just Another Set of Risks, Management Owns the Risk Decision, Qualitative versus Quantitative Risk Analysis, Risk Management Process, Risk Mitigation Options, Why Information Security Policies Are Important, Avoiding Shelfware, Electronic Policy Distribution, Canned Security Policies, Policies, Standards, Guidelines Definitions, An Approach for Developing Information Security, Policies, Utilizing the Security Council for Policies, The Policy Review Process.

UNIT II: Security Compliance Using Control Frameworks And Managerial Controls: Practical Security Considerations Overview, Security Control Convergence, Security Control Methodology, Security Assessment and Authorization Controls, Planning Controls, Risk Assessment Controls, System and Services Acquisition Controls, Program Management Controls, Overview, Access Control Controls, Audit and Accountability, Controls, Identification and Authentication, System and Communications Protections, Overview, Awareness and Training Controls, Configuration Management Controls, Contingency Planning Controls, Incident Response Controls, Maintenance Controls, Media Protection Controls, Physical and Environmental Protection Controls, Personnel Security Controls, System and Information Integrity Controls, Overview, Anatomy of an Audit, Audit Planning Phase, On-Site Arrival Phase, Audit Execution Phase, Entrance, Exit, and Status Conferences, Report Issuance and Finding Remediation Phase, Why a Chapter Dedicated to Security Communications?, End User Security Awareness Training, Delivering the Message, Security Awareness Training Does Not Have to Be Boring, Security Officer Communication Skills, Applying Personality Type to Security Communications, Overview, Security Control Convergence, Security Control Methodology, Security Assessment and Authorization Controls, Planning Controls, Risk Assessment Controls, System and Services Acquisition Controls, Program Management Controls. Recent Security Incidents, Who Will Be Next?, Every Control Could Result in an Incident. 17 Ways to Dismantle Information Security Governance Efforts

UNIT III: Introduction to Information Security Management, Concepts, Security Life Cycle and Security Plan Overview, Why Information Security Matters, Information Sensitivity Classification, Information Security Governance, The Computing Environment, Security of Various Components in the Computing Environment, Security Interdependence, CIA Triad, Security Goals versus Business Goals, The Security Star, Parker's View of Information Security, What Is Information Security Management?, Defense-In-Depth Security, Security Controls, The NSA Triad for Security Assessment Brief History of Management, Traditional Management Skills and Security Literacy, Managerial Skills, Redefining Mintzberg's Managerial Roles, Strategic Management Concepts, IS Security Management Activities, Do We Really Need an Independent Information Security Functional Unit?, The Information Security Management Cycle, IS Security Management versus Functional Management, Security Planning in the SLC, Security Analysis, Security Design, Security Implementation, Security Review, Continual Security, Overview, SP Development Guidelines, SP Methodology, Security Policy - Overview, Security Policy, Standards, and Guidelines, Security Policy Methodologies, Business Continuity Planning - Business Disruptions, Business Continuity, Disaster Recovery, Responding to Business Disruptions, Developing a BCP

UNIT IV: Security Analysis, Security Design and Security Risk Management Introduction, The Risk Management Life Cycle, The Preparation Effort for Risk Management, A Sustainable Security Culture, Information Needed to Manage Risks, Factors Affecting Security risk, The ALE Risk Methodology, Operational, Functional, and Strategic Risks, Operational Risk Management: Case of the Naval Safety Center, The ABLE methodology, Continual Security: Integrated Fault-Event Analysis and Response Framework (IFEAR)- Introduction, IFEAR Methodology, Fault Tree Analysis, Event Tree Analysis, FTA-ETA Integration, Risk Management, Simulation and Sensitivity Analysis, Active Security Assessment - Introduction, Standards for Active Security Assessment, Limits of Active Security Assessment, Can You Hack Your Own System?, Ethical Hacking of a Computing Environment, Ethics in Ethical Hacking, ASA through Penetration Testing, Strategies for Active Security Assessment, Guidelines and Terms between Testers and the Organization, The Active Security Assessment Project System Availability - Introduction, Computer Clustering, Review of Cluster Concepts, Types of Clusters, Web Site Availability, Application Centers No Longer the Only Sound Implementation, Computation of Availability in High-Availability Cluster, Related Availability Definitions, How to Obtain Higher Availability: The Cisco Process, Common Configurations for Clusters, Self-Healing and Availability. Nominal Security Enhancement Design Based on ISQ/IEC 27002 - Introduction, History of the ISO/IEC 27002, ISO/IEC 27002, How to Use the ISO/IEC 27002 to Enhance Security, Measurement and Implementations, Strategies to Enhance the ISO/IEC 27002-Based Security Posture, Comparing the ISO/IEC 27002-Based Security Posture Enhancement Strategies Technical Security Enhancement Based on ISO/IEC 27001 - Introduction, How Organizations Interact with the Standards, General ISMS Framework, The ISMS Model, The Process Approach Ensures the Continual Improvement of the ISMS, Development of the Information Security Management System, Design of the ISMS, Security Inventory Needs, The Integration of ISMS Subsystems, Self-Assessment for Compliance, Revisiting ISMS Scoping.

UNIT V: Security Implementation, Security Review and Continual Security Security Solutions - Introduction, Security Solutions, The NIST Security Solution Taxonomy, The ISO Security Solution Taxonomy The Common Criteria - The Birth of the Common Criteria, Common Uses of the CC, The CC Document, The CC Security Approach, Information Resource Evaluation Methodology, CC Security Evaluation Programs, The American Model of CC Evaluation Programs, A National Model, Some Other CC Evaluation Requirements. Security Review through Security Audit - Introduction, Security Audit Means Different Things to Different People, Some Security Audit Activities, Our Definition of Security Audit, Main Features in Security Audit, Application Audit, How Does Security Audit Relate to the Corporate Security Policy?, Structure of a Security Audit, Security Audit versus IT Auditing, Applicable Security-Related Standards, Security Audit Grades, Privacy Rights, Information Technology, and HIPAA - The Problem of Privacy, The Meaning of Privacy, HIPAA, Regulatory Standards: The Privacy Rule, The HIPAA Security Rule, Administrative Safeguards, NIST on HIPAA, Conducting

Effective Risk Analysis

TEXT BOOK(S):

1. Information Security Governance, Management Practices, Information Security Audit Monitoring(IBM ICE Publications)

5.5 216CSE2201: COMPETITIVE PROGRAMMING

216CSE2201	COMPETITIVE PROGRAMMING	L	T	P	X	C
		0	0	2	0	1
Pre-requisite : Programming Language (C/Python/Java)						
Course Category : Experiential Elective						
Course Type : Practical						

OBJECTIVE(S):

- Develop the skills for solving complex problems leveraging Computer Programming
- Prepare for the campus placements in top level industries requiring power coding capabilities
- Obtain internship offers from the industries.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to
CO1: Understand the basic problems in mathematics and String processing.
CO2: Develop computationally efficient solutions using data structures.
CO3: Apply the different approaches for solving the problems using logical and design thinking

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S												PSO'S	
CO'S	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S	S	S			S	S			S	S	
CO2	S	S	S	S	S	M	M	S	S			S	S	
CO3	S	S	S	S	S			S	S	L	L	S	S	

COURSE TOPIC(S):

MODULE I: ADHOC MATHEMATICS PROBLEMS AND STRING PROCESSING Number Theory : Prime Numbers, GCD, LCM, Euler's Totient (Phi) Function – Modulo Arithmetic – Fibonacci Numbers, Factorial Number – String Processing with Dynamic Programming: String Alignment, Longest Common Sequence, Palindrome – Suffix tree and Suffix array.

MODULE II: DATA STRUCTURES AND LIBRARIES Tips to the competitive programming – Data structures with Built in Libraries: Linear Data Structure, Non Linear Data Structure – Data Structures with our Own Libraries: Graph, Union-Find Disjoint sets- Segment Tree.

MODULE III : PROBLEM SOLVING PARADIGMS AND GRAPHS Complete Search – Examples – Divide and Conquer: Usage of Binary Search – Greedy Algorithm: Classical and Non Classical Example – Dynamic Programming – Graph: Depth First Search –Breadth First Search – Kruskal's algorithm – Dijkstras's algorithm – Bellman's algorithm- Ford's Algorithm – Floyd Warshall's Algorithm.

TEXT BOOK(S):

1. Steven Halim, Felix Halim, Competitive Programming.

Credits will be earned if any one of the following is satisfied:

1. Participate in Industry level coding competition and get a recognition.
2. Participate in coding competitions organized in any of the Top-100 NIRF institutions.
3. Participate in the coding competition conducted by KARE and reach Top-20 position in dashboard

5.6 216CSE3201: MICRO PROJECT

216CSE3201	MICRO PROJECT	L 0	T 0	P 2	X 0	C 1
Pre-requisite :NIL **Course Category :**Experiential Elective **Course Type :**Practical						

OBJECTIVE(S):

- Understand state-of-the-art technologies pertaining to the areas of interest
- Get insights on the existing tools and methodologies for solving complex problems

COURSE OUTCOMES:

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

CO1: Analyze the use cases of state-of-the-art technologies to solve complex problems
CO2: Demonstrate the applications of specific tool/technology in solving a particular problem pertaining to the domain of study.

MAPPING OF COURSE OUTCOMES WITH PO:

	PO'S												PSO'S	
CO'S	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S	S	S	S			S	S			S	S	
CO2	S	S	S	S	S	M	M	S	S			S	S	

Complete the following to earn the credit:

1. Survey and select courses pertaining to Mainstream technologies (Artificial Intelligence & Machine Learning/ Cyber Security & Forensics/ Data Analytics/ Internet of Things/ Networking/ Software Development)
2. With the approval by a mentor, complete the course with certification
3. Demonstrate the learnt technology through a working model

REFERENCES:

1. NPTEL: `https://nptel.ac.in/`
2. Coursera: `https://www.coursera.org/in`
3. EdX: `https://www.edx.org/`
4. Udemy: `https://www.udemy.com/`

6 HONORS ELECTIVE

6.1 213CSE2101: ADVANCED WEB FRAMEWORKS

213CSE2101	Advanced Web Frameworks	L 3	T 0	P 0	X 0	C 3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

Understand client server architecture and able to use the skills for web project development Create job opportunities as a web developer.

COURSE OUTCOMES:

CO1: Develop a static, interactive and well-formed webpage using HTML.

CO2: Develop necessary skills for designing and developing web applications using JavaScript.

CO3: Analyze React JS and Angular JS to create reusable components for web and mobile apps.

CO4: Apply Object Oriented concepts in developing PHP applications.

CO5: Create and deploy scalable web based system using Laravel

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S							L					S	
CO2	S	S	S	S	S							M	S	
CO3	S							M					S	
CO4	S	M	M	M	M								S	
CO5	S	S	S	S	S				L		M	M	S	

UNIT I: HTML Basics

HTML Introduction, HTML Elements, Attributes, HTML Headings, Paragraphs, HTML Formatting, Fonts, Styles, HTML Links, Images, Tables, HTML Lists, Forms, Frames, HTML Colors, Color names, Color values, HTML Quick List.

UNIT II: JavaScript Programming

Intro to JavaScript- Variables- JavaScript Programming- Writing Functions- Dynamic Web Page Creation- JavaScript Graphics- Built in Functions Methods- Object Oriented JavaScript- Javascript Loops- Events- IFRAME and jQuery- Windows and Javascript- JavaScript Forms

UNIT III: Angular JS and React JS

Angular JS Basics- Angular Expressions- Angular JS Filters- Angular JS directives- Angular JS Modules- Angular JS Forms- Introduction to React JS- React Components- Build a simple React component- React internals- Component composition- - Component styling- Add styles to your components

UNIT IV: Object Oriented PHP

Object Oriented Programming with PHP – Classes, Properties, Methods, Constructor, Destructor, Inheritance

UNIT V: PHP MVC Framework - Laravel

Introduction to Laravel and MVC, Environment Setup, Routes, Namespaces, Controllers, Views, Request Response, Redirections, Forms, Session, Cookie, Database Connectivity and CRUD operations.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy
Week 1	HTML Introduction HTML Elements, Attributes HTML Headings, Paragraphs	Power point presentation
Week 2	HTML Formatting, Fonts, Styles HTML Links, Images, Tables HTML Lists, Forms, Frames	Explicit Teaching Power point presentation, Flipped videos
Week 3	HTML Colors, Color names, Color values HTML Quick List. Intro to JavaScript- Variables	Explicit Teaching peer learning
Week 4	JavaScript Programming- Writing Functions Dynamic Web Page Creation JavaScript Graphics	Seminar Self-Study Topic Power Point presentation, case studies
Week 5	Built in Functions Methods Object Oriented JavaScript- Javascript Loops Events,IFRAME and jQuery- Windows and Javascript	Explicit Teaching, case studies
Week 6	Case study: JavaScript Forms Angular JS Basics Angular Expressions	Power point presentation, Flipped videos, case studies

Week 7	Angular JS Filters Angular JS directives Angular JS Modules	Power point presentation
Week 8	Angular JS Forms Introduction to React JS React Components	Problem based Learning Video presentation
Week 9	Build a simple React component React internals Component composition	Explicit Teaching
Week 10	Component styling Add styles to your components Object Oriented Programming with PHP	Power point presentation, Case Studies
Week 11	Classes Properties Methods	Power point presentation, Flipped videos
Week 12	Constructor Destructor Inheritance	Power point presentation, Flipped videos
Week 13	Introduction to Laravel and MVC Environment Setup Routes	peer learning, Case Studies
Week 14	Namespaces, Controllers Views, Request Response Redirections, Forms	Power point presentation, Flipped videos
Week 15	Session Cookie Database Connectivity and CRUD operations.	Explicit Teaching

REFERENCES:

1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Black BookKindle Edition, by Kogent Learning Solutions Inc, 2012.

2. PHP: The Complete Reference, By Steven Holzner. Publisher: Tata McGraw Hill, 2007.

3. Laravel: Up and Running, By Matt Stauffer. Publisher: O'Reilly Media, 2016.

6.2 213CSE2102: BLOCKCHAIN TECHNOLOGY

213CSE2102	BlockChain Technology	L	T	P	X	C
		3	0	0	0	3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

Understand how block chain systems (mainly Bitcoin and Ethereum) work. To securely interact with them. Design, build, and deploy smart contracts and distributed applications. Integrate ideas from block chain technology into their own projects.

COURSE OUTCOMES:

CO1: Understand emerging abstract models for Blockchain Technology.

CO2: Analyze major research challenges and technical gaps existing between theory and practice in crypto currency domain.

CO3: Understand the Bitcoin concepts clearly and persuasively.

CO4: Understand the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO5: Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S							S					S	
CO2	S	M	M	M	M					S	L		S	
CO3	S								M		M		S	
CO4	S	M	M	M	M			L					S	
CO5	S	S	S	S	S		M		M		M	M	S	

UNIT I: INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II: BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network.

UNIT III: BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos.

UNIT IV: DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance.

UNIT V: HYPER LEDGER FABRIC ETHERUM

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency, Mining, DApps, DAO.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy
Week 1	Blockchain- Public Ledgers Bitcoin, Blockchain 2.0 Smart Contracts, Block in a Blockchain	Power point presentation and Flipped videos
Week 2	Parallel Databases: Transactions-Distributed Consensus The Chain and the Longest Chain Cryptocurrency to Blockchain 2.0	Explicit Teaching
Week 3	Permissioned Model of Blockchain Cryptographic Hash Function	Explicit Teaching peer learning
Week 4	AProperties of a hash function Hash pointer and Merkle tree A basic crypto currency	Seminar Self-Study Topic Power Point presentation

Week 5	Creation of coins Payments and double spending, FORTH the precursor for Bitcoin scripting, Bitcoin Scripts	Power point presentation Video presentation
Week 6	Bitcoin P2P Network Transaction in Bitcoin Network, Block Mining Block propagation and block relay	Power point presentation, Flipped videos
Week 7	Case Study:Consensus introduction, Distributed consensus in open environments Consensus in a Bitcoin network Bitcoin Consensus, Proof of Work (PoW)	case studies, Power point presentation
Week 8	Hashcash PoW , Bitcoin PoW Attacks on PoW ,monopoly problem- Proof of Stake Proof of Burn - Proof of Elapsed Time	Collaborative Teaching – Seminar Self-Study Topic
Week 9	Bitcoin Miner, Mining Difficulty, Mining Pool Permissioned model and use cases Design issues for Permissioned Blockchains	Explicit Teaching
Week 10	Execute contracts- Consensus models for permissioned blockchain Distributed consensus in closed environment Paxos.RAFT Consensus	Power point presentation, Case Studies
Week 11	Byzantine general problem Byzantine fault tolerant system Agreement Protocol	Power point presentation, Flipped videos
Week 12	Lamport-Shostak Pease BFT Algorithm BFT over Asynchronous systems	Power point presentation, Flipped videos
Week 13	Practical Byzantine Fault Tolerance. Architecture of Hyperledger fabric v1.1 Introduction to hyperledger fabric v1.1	Power point presentation
Week 14	chain code- Ethereum: Ethereum network EVM, Transaction fee Mist Browser, Ether	Power point presentation, Flipped videos

Week 15	Gas, Solidity, Smart contracts Truffle Design and issue Crypto currency, Mining, DApps, DAO.	Explicit Teaching, Case Studies

REFERENCES:

1. T1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran, 2017.

2. 2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

6.3 213CSE2103: VIDEO ANALYTICS

213CSE2103	Video Analytics	L	T	P	X	C
		3	0	0	0	3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

- To address the research issues towards developing algorithms for video Analysis that can perform high-level problem solving.
- To do visual recognition tasks on real-world images and videos.
- To review and discuss current approaches to high-level visual recognition problems, such as background modeling, object recognition and categorization, tracking, scene understanding, human motion understanding, etc.

COURSE OUTCOMES:

CO1: Understand the basic features of modeling, shadowing and tracking.

CO2: Apply principles of Data Science to the . analysis of large-scale problems.

CO3: Understand the fundamental principles of video analytics and their application.

CO4: Understand behavioral analysis and identify suspicious activity of human.

CO5: Analyze the various human face recognition and gait algorithms

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	S			S			M		S		S	S	
CO2		M	M								M		S	
CO3				S						S		S	S	
CO4					M	M	M					M	S	
CO5						L				S		S	S	

UNIT I: INTRODUCTION

Computer Vision: Challenges- Spatial Domain Processing – Frequency Domain Processing-Background Modeling-Shadow Detection-Eigen Faces - Object Detection -Local Features-Mean Shift: Clustering, Tracking - Object Tracking using Active Contours

UNIT II: Tracking and Video Analysis

Tracking and Motion Understanding – Kalman filters, condensation, particle, Bayesian filters, hidden Markov models, change detection and model based tracking- Motion estimation and Compensation-Block Matching Method, Hierarchical Block Matching, Overlapped Block Motion and compensation,Pel Recursive Motion Estimation, Mesh Based Method, Optical Flow Method - Motion Segmentation -Thresholding for Change Detection, Estimation of Model parameters

UNIT III: VIDEO ANALYTICS ON FIELD

Introduction Video Basics Fundamentals for Video Surveillance Scene Artifacts Object Detection and Tracking: Adaptive Background Modelling and Subtraction Pedestrian Detection and Tracking Vehicle Detection and Tracking Articulated Human Motion Tracking in Low Dimensional Latent Spaces.

UNIT IV: BEHAVIOURAL ANALYSIS AND ACTIVITY RECOGNITION

Event Modelling Behavioural Analysis Human Activity Recognition Complex Activity Recognition Activity modeling using 3D shape - Video summarization shape based activity models Suspicious Activity Detection.

UNIT V: HUMAN FACE RECOGNITION AND GAIT ANALYSIS

Introduction: Overview of Recognition algorithms Human Recognition using Face: Face Recognition from still images Face Recognition from video Evaluation of Face Recognition Technologies Human Recognition using gait: HMM Framework for Gait Recognition View Invariant Gait Recognition Role of Shape and Dynamics in Gait Recognition.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy

Week 1	Computer Vision: Challenges- Spatial Domain Processing – Frequency Domain Processing-Background Modeling-Shadow Detection-Eigen Faces - Object Detection -Local Features	PPT, Demonstration
Week 2	Mean Shift: Clustering, Tracking - Object Tracking using Active Contours, Tracking and Motion Understanding – Kalman filters, condensation, particle, Bayesian filters	Problem solving
Week 3	hidden Markov models, change detection and model based tracking- Motion estimation and Compensation-Block Matching Method, Hierarchical Block Matching	Problem Solving, PPT
Week 4	Overlapped Block Motion and compensation,Pel-Recursive Motion Estimation, Mesh Based Method	PPT,Problem Solving, Flipped Learning
Week 5	Optical Flow Method - Motion Segmentation - Thresholding for Change Detection, Estimation of Model parameters	PPT,Problem Solving, demonstration
Week 6	Introduction Video Basics Fundamentals for Video Surveillance Scene Artifacts Object Detection and Tracking	Case study, Seminar
Week 7	Adaptive Background Modelling and Subtraction Pedestrian Detection and Tracking Vehicle Detection and Tracking Articulated	Flipped Learning, Demonstration
Week 8	Human Motion Tracking in Low Dimensional Latent Spaces, , Natural Scene Videos, Crowd Analysis	PPT, case study

Week 9	Event Modelling Behavioural Analysis Human Activity Recognition Complex Activity Recognition	Case Study
Week 10	Activity modeling using 3D shape	PPT
Week 11	Video summarization shape based activity models Suspicious Activity Detection,Video Segmentation and Key Frame Extraction	Flipped Learning , PPT
Week 12	introduction: Overview of Recognition algorithms Human Recognition using Face: Face Recognition from still images	PPT, case study
Week 13	Face Recognition from video Evaluation of Face Recognition Technologies.	Demonstration
Week 14	Human Recognition using gait: HMM Framework for Gait Recognition View	Case study
Week 15	Invariant Gait Recognition Role of Shape and Dynamics in Gait Recognition	Case study

REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

2. Yunqian Ma, Gang Qian, Intelligent Video Surveillance: Systems and Technology, CRC Press (Taylor and Francis Group), 2009.

3. Michael Berthold, David J.Hand, Intelligent Data Analysis, Springer, 2007.

4. Rama Chellappa, Amit K.Roy Chowdhury, Kevin Zhou.S, Recognition of Humans and theirActivities using Video, Morgan Claypool Publishers, 2005.

6.4 213CSE3101:ADVANCED COMPUTER ARCHITECTURE

213CSE3101	**ADVANCED COMPUTER ARCHI TECTURE**	**L**	**T**	**P**	**X**	**C**
		3	0	0	0	3
Pre-requisite : Nil **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

- To introduce students about the principles of computer design, instruction set design concepts, performance enhancements, new and alternative computer architectures, and the design and implementation of high performance computing systems.
- To equip students with the skills to undertake performance comparisons, improve the performance of applications, and develop applications to solve computationally intensive problems.

COURSE OUTCOMES:

CO1: Understand the fundamentals of computer design.

CO2: Demonstrate the knowledge of pipelining and ILP to solve the designing issues.

CO3: the various issues in architecture and thread level parallelism.

CO4: the various multiprocessor architecture.

CO5: Demonstrate the memory and I/O interface concepts

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			M			M	M				M	S	
CO2		S	S	M	M				S	M	S		S	
CO3					M					M			S	
CO4	S	S								S			S	
CO5				M	M	M			M		S		S	

UNIT I: FUNDAMENTALS OF COMPUTER DESIGN

Parallel Programming Techniques:Loop Splitting – Ideal Speedup – Spin-Locks, Contention And Self Scheduling. Scheduling : Loop Scheduling – Variations On Loop Scheduling – Self Scheduling – Variations On Self-Scheduling – Indirect Scheduling – Block Scheduling

UNIT II: PIPELINING AND ILP

Fundamentals of Computer Design - Measuring and Reporting Performance - Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Overcoming Data Hazards with Dynamic Scheduling Dynamic Branch Prediction

UNIT III:THREAD LEVEL PARALLELISM

Multi-threading Multiprocessors - Centralized and Distributed Shared Memory Architectures Cache Coherence Issues - Performance Issues Synchronization Issues Models of Memory Consistency Buses,-SMT Architecture and Performance

UNIT IV: MULTIPROCESSOR ARCHITECTURE

Taxonomy of Parallel Architectures - Centralized Shared Memory Architecture - Synchronization - Memory Consistency - Symmetric and Distributed Shared Memory Architectures - SISD, MISD, MIMD, Single Instruction Multiple Data Stream (SIMD) Architectures

UNIT V:MEMORY AND I/O

Latency hiding technique, Principles of multithreading, fine grain multi computer, scalable and multithreaded architecture, Dataflow and hybrid architecture

TEXT BOOK(S):

1. John L. Hennessey and David A. Patterson, Computer Architecture A Quantitative Approach, Morgan Kaufmann / Elsevier, Fifth edition, 2012.

2. Richard Y. Kain, Advanced Computer Architecture a Systems Design Approach, PHI, 2011.

REFERENCES:

1. Kai Hwang and Faye Briggs, Computer Architecture and Parallel Processing, Mc Graw-Hill International Edition, 2000.

2. John P.Hayes, Computer architecture and Organization, Tata McGraw Hill, Third edition, 1998.

3. David E. Culler, Jaswinder Pal Singh, Parallel computing architecture : A hardware/software approach , Morgan Kaufmann /Elsevier Publishers, 1999

6.5 213CSE3102: AUGMENTED REALITY

213CSE3102	**AUGMENTED REALITY**	**L**	**T**	**P**	**X**	**C**
		3	0	0	0	3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

- To introduce students to augmented reality technology
- To expose students to the various capabilities of augmented reality technology
- To equip student with technical knowledge in creating an augmented reality application

COURSE OUTCOMES:

CO1: Understand the basic concept and display devices used for augmented reality.

CO2: Understand and apply various tracking systems using in AR.

CO3: Understand the visualization through camera and analyze the visualization challenges.

CO4: Apply modeling, annotations and collaborating and navigating with AR environment.

CO5: Analyze the software engineering requirements for an AR developer and predict the future of AR.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M				S	M			S		S	S	
CO2	S			S		S		L			M	M	S	
CO3	S	M			M	S						M	S	
CO4	S		S			S		L	L				S	
CO5	S					S			M	L	L		S	

UNIT I: INTRODUCTION OF AUGMENTED REALITY

Definition and Scope, Examples, Related Fields, Displays Multimodal Displays, Visual Perception, Spatial and Visual Displays, Primary Features and Present Development on Virtual Reality. Applications in various fields, Threats.

UNIT II: TRACKING

Coordinate system, Characteristics of Tracking Technology, Stationary Tracking System, Mobile Sensors, Optical Tracking, Computer Vision for Augmented Reality. Multiple Models of Input and Output Interface in Virtual Reality: Input Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus and 3DScanner etc. Output Visual, Auditory, Haptic Devices.

UNIT III: CALIBRATION, REGISTRATION, COHERENCE,VISUALIZA

Camera and Display Calibration, Registration, Visual Coherence, Situated Visualization Challenges and Registration, Annotations and Labeling, X-ray Visualization, Spatial Manipulation and Information Filtering.

UNIT IV: MODELING, ANNOTATIONS, AUTHORING, NAVIGATION AND COLLABORATION

Specifying Geometry and Appearance, Annotation, Requirements, Elements and Solutions of AR Authoring, Navigation, Properties, Co-located and Remote Collaboration and its case study.

UNIT V: SOFTWARE ARCHITECTURE AND FUTURE

AR Application and Software Engineering Requirements, Developer Support and Wish List, Interfacing with Smart Objects, Augmented Human, AR as a Social Computing

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy
Week 1	Definition and Scope, Examples, Related Fields, Displays Multimodal Displays, Visual Perception, Spatial and Visual Displays, Applications in various fields, Threats.	PPT, Video Presentation

Week 2	Primary Features and Present Development on Virtual Reality, Coordinate system, Characteristics of Tracking Technology, Stationary Tracking System, Mobile Sensors, Optical Tracking	PPT, Case study
Week 3	Multiple Models of Input and Output Interface in Virtual Reality,Computer Vision for Augmented Reality, Input Tracker, Sensor, Digital Glove	PPT, Video Presentation, Peer Learning
Week 4	Movement Capture, Video-based Input, 3D Menus and 3D Scanner etc.	PPT, Video Presentation, Peer Learning
Week 5	Output :Visual, Auditory, Haptic Devices, Camera and Display Calibration, Registration, Visual Coherence	PPT, Flipped Learning
Week 6	Situated Visualization Challenges and Registration, X-ray Visualization, Spatial Manipulation and Information Filtering	PPT, Video Presentation, Peer Learning
Week 7	Annotations and Labeling	PPT
Week 8	Specifying Geometry and Appearance	PPT, Problem solving
Week 9	Annotation, Requirements,Elements and Solutions of AR Authoring	PPT, Demonstration
Week 10	Navigation, Properties, Co-located and Remote Collaboration	Demonstration, Flipped video, PPT
Week 11	AR Application and Software Engineering Requirements	Case Study, PPT, Problem Solving
Week 12	Developer Support and Wish List, Interfacing with Smart Objects	Video Presentation, Demonstration
Week 13	Augmented Human	Case Study, Video presentation

Week 14	Interactive Techniques in Virtual Reality	PPT, Case study
Week 15	AR as a Social Computing Platform	PPT

REFERENCES:

1. D.Schmalstieg, T.Hollerer, "Augmented Reality: Principles Practice", Addison Wesley - Pearson Education, 2016.

2. Helen Papagiannis, Augmented Human: How Technology Is Shaping the New Reality, Oreiley, 2016.

3. Sean Morey , John Tinnell, Augmented Reality: Innovative Perspectives Across Art, Industry, and Academia, Parlor Press, 2016.

4. Melissa Bosworth, Lakshmi Sarah, Crafting Stories for Virtual Reality, Routledge, 2018.

6.6 213CSE3103: ADVANCED DATABASES

213CSE3103	ADVANCED DATABASES	L 3	T 0	P 0	X 0	C 3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

To acquire knowledge on parallel and distributed databases and its applications.
To study the usage and applications of Object Oriented and Intelligent databases.
To understand the emerging databases like Mobile, XML, Cloud and Big Data

COURSE OUTCOMES:

CO1: Demonstrate the usage of high performance database like parallel and distributed database.

CO2: Create the real world data using object oriented database.

CO3: Apply the rule set in the database to implement intelligent databases.

CO4: Organize the data using XML database for better interoperability.

CO5: Implement big data and store in a transparent manner in the cloud.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S						L						S	
CO2	S	M	M	M	M						M		S	
CO3	S						M			M		M	S	
CO4	S	M	M	M	M			M				M	S	
CO5	S	M	M	M	M					L		M	S	

UNIT I: PARALLEL AND DISTRIBUTED DATABASES

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies.

UNIT II: INTELLIGENT DATABASES

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2) - Taxonomy – Applications - Design Principles for Active Rules - Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases - Recursive Queries in SQL - Spatial Databases-Spatial Data Types – Spatial Relationships - Spatial Data Structures - Spatial Access Methods - Spatial DB Implementation.

UNIT III: OBJECT AND XML DATABASES

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance. XML Databases: XML - Related Technologies - XML Schema - XML Query Languages - Storing XML in Databases - XML and SQL.

UNIT IV: MOBILE AND MULTIMEDIA DATABASES

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management -Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control -Transaction Commit Protocols - Multimedia Databases - Image Databases – Audio Databases - Video Databases.

UNIT V: EMERGING TECHNOLOGIES

Web Databases - Geographic Information Systems - Biological Data Management - Cloud Based Databases: Data Storage Systems on the Cloud - Cloud Storage Architectures - Cloud Data Models- Query Languages - Introduction to Big Data-Storage - Analysis.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy
Week 1	Database System Architectures Centralized and ClientServer Architectures Server System Architectures Parallel Systems Distributed Systems	Power point presentation and Flipped videos
Week 2	Parallel Databases: I/O Parallelism Inter and Intra Query Parallelism Inter and Intra operation Parallelism Distributed Transactions	Explicit Teaching Power point presentation, Flipped videos
Week 3	Distributed Database Concepts Distributed Data Storage Design of Parallel Systems	Explicit Teaching peer learning

Week 4	Active Databases Syntax and Semantics (Starburst, Oracle, DB2) Taxonomy Spatial Databases, Recursive Queries in SQL	Collaborative Teaching – Seminar Self-Study Topic Power Point presesnattion, case studies
Week 5	Types Spatial Relationships Spatial Data Structures Spatial Access Methods Case study: Spatial DB Implementation	Explicit Teaching, case studies
Week 6	Concepts for Object Databases: Object Identity Object structure Type Constructors Methods Persistence Type and Class Hierarchies Inheritance	Power point presentation, Flipped videos
Week 7	Encapsulation of Operations XML Databases: XML Related Technologies XML Schema XML Query Languages	Power point presentation
Week 8	Storing XML in Databases Location Dependent Data Distribution Mobile Transaction Models	Problem based Learning Video presentation
Week 9	Concurrency Control Transaction Commit Protocols Multimedia Databases	Explicit Teaching
Week 10	T Image Databases Audio Databases Case Study: Video Databases	Power point presentation, Case Studies
Week 11	Applications Control Distributed Query Processing Web Databases	Power point presentation, Flipped videos
Week 12	Geographic Information Systems, Biological Data Management Cloud Based Databases	Power point presentation, Flipped videos
Week 13	Data Storage Systems on the Cloud Cloud Storage Architectures Cloud Data Models	peer learning, Case Studies
Week 14	Query Languages , Introduction to Big Data Storage	Power point presentation, Flipped videos
Week 15	Analysis XML and SQL Commit Protocols Concurrency	Explicit Teaching

TEXT BOOK(S):

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”,Sixth Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.

REFERENCES:

1. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007
2. C.J.Date, A.Kannan and S.Swamynathan, ”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
3. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition 2004

6.7 213CSE4101: HIGH PERFORMANCE COMPUTING

213CSE4101	HIGH PERFORMANCE COMPUTING	L	T	P	X	C
		3	0	0	0	3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

- The objective is to familiarize students with the fundamental concepts, techniques and tools of parallel computing.
- It will enable the students to better understand parallel computing in the application area, and will prepare you to take advanced courses in more specific areas of parallel computing.

COURSE OUTCOMES:

CO1: Understand the evolution of High Performance Computing (HPC) with respect to laws and the contemporary notion that involves mobility for data, hardware devices and software agents.

CO2: Understand, appreciate and apply parallel and distributed algorithms in problem Solving.

CO3: the impact of network topology on parallel/distributed algorithm formulations and traffic their performance.

CO4: Obtain hand-on experience with the agent-based and Internet-based parallel and distributed programming techniques.

CO5: Recognize the master skills to measure the performance of parallel and distributed programs.

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S		M			S		S		M		S	S	
CO2	S		M							M			S	
CO3	S		M				M		S		M		S	
CO4		L		M	S					M			S	
CO5		S		L		S						S	S	

UNIT I:Introduction and Process

Introduction: Parallel Processing – Shared Memory Multiprocessing – Distributed Shared Memory – Message Passing Parallel Computers. Processes Shared Memory Programming: Processes - Shared Memory Programming – General Model Of Shared Memory Programming – Forking-Creating Processes – Joining Processes -Process Model Under UNIX

UNIT II: Techniques and Scheduling

Parallel Programming Techniques:Loop Splitting – Ideal Speedup – Spin-Locks, Contention And Self Scheduling. Scheduling : Loop Scheduling – Variations On Loop Scheduling – Self Scheduling – Variations On Self-Scheduling – Indirect Scheduling – Block Scheduling

UNIT III: Network and Memory

Taxonomy of parallel computing paradigms Shared memory computers- Cache coherance-UMA - ccNUMA Distributed-memory computers- Hierarchical systems- NetworksBasic performance characteristics- Buses- Switched and fat- tree networks- Mesh networks- Hybrids - Basics of parallelization - Why parallelize - Data Parallelism - Function Parallelism-Parallel Scalability- Factors that limit parallel execution- Scalability metrics

UNIT IV: Message Passing Paradigm

Programming Using the Message Passing Paradigm, Principles of Message-Passing Programming.The Building Blocks: Send and Receive Operations. MPI: The Message Passing Interface. Topologies and Embedding. Overlapping Communication with Computation. Collective Communication and Computation Operations

UNIT V:Algorithms For Parallel Machines

Models Of Computation – Analysis Of Parallel Algorithms – Prefix Computation – Histogram Computation – Parallel Reduction – SortingNetworks - Matrix Multiplication

TEXT BOOK(S):

1. Introduction To Parallel Programming - By Steven Brawer.
2. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, By Pearson Publication.
3. Introduction To Parallel Processing – By M.Sasikumar, Dinesh Shikhare And P. Ravi Prakash.

REFERENCES:

1. R. Buyya, High Performance Cluster Computing: Architectures and Systems, Vol:1, Pearson Education, 2008.

2. I. Foster and C. Kesselman, The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Elsevier, 2004.

3. C.S.R.Prabhu, Grid and Cluster Computing, PHI, 2008.

4. B.Sosinsky, Cloud Computing Bible, Wiley, 2011.

5. D.Janakiram, Grid Computing, Tata McGraw-Hill, 2005.

6. R.Buyya, C.Vecchiola and S.T.Selvi, Mastering Cloud Computing Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.

6.8 213CSE4102: NEXT GENERATION NETWORKS

213CSE4102	NEXT GENERATION NETWORKS	L	T	P	X	C
		3	0	0	0	3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

To make students to understand the core technologies, theories, and dilemmas that face next generation network engineers in this field. To introduce students the best practices about how to design, deploy, and troubleshoot next generation networks.

COURSE OUTCOMES:

CO1: Understand the technical, economic and service advantages of next generation networks.

CO2: Understand with NGN Functional Architecture of a next generation network (NGN) with reference.

CO3: Analyze various NGN key development areas such as Access Network Area, Core Transport Network Area, Service Creation Area and Advanced Technologies for Network and Service Management.

CO4: Compare various NGN Standards in the vein of TMF, NGOSS, 3GPP and LTE/SAE.

CO5: Analyze the various Wireless Application Protocol (WAP) WAP, MMS, GPRS application, CDMA and 3G

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S									L	L		S	
CO2	S	M	M	M	M								S	
CO3	S								M				S	
CO4	S	M	M	M	M			L					S	
CO5	S	M	M	M	M					M		M	S	

UNIT I: INTRODUCTION

Next Generation Networks (NGN) Vision, Scenarios and Advances NGN Networks : Perspectives and Advances Some Possible Scenarios Virtual International Congress Virtual Class Rooms e-Education and Experimental Laboratory Virtual Home Home Networks Automatic Tra?c and Car Driving NGN Requirements on Technology and Management.

UNIT II: NGN FUNCTIONAL ARCHITECTURE

ITU NGN Functional Architecture Proposed NGN Functional Architecture NGN Network Operator NGN Network Service Provider NGN Customer and CTE Network and Service Evaluation towards NGN- Fixed Network Evaluation Mobile Network Evaluation Internet Evaluation

UNIT III:NGN KEY DEVELOPMENT AREAS

Terminal Area Access Network Area Backhaul Network Area Core Transport Network Area Service Creation Area Network Control and Managerial Area Service Control and Management Advanced Technologies for Network and Service Management.

UNIT IV: NGN STANDARDIZATION

ITU and GSI NGN ETSI and TISPAN - NGN ATIS and NGN CJA and NGN - TMF and NGOSS, NGMN Alliance and NGMN - 3GPP and LTE/SAE NGMN Alliance and NGMN, 3GPP and LTE/SAE

UNIT V: WIRELESS APPLICATION PROTOCOL

Spread-spectrum Technology, FHSS, DSSS, CDMA versus GSM, Wireless data, third generation networks, applications in 3G Wireless LAN, WiFi v/s 3G Voice over Internet protocol and convergence, Voice over IP,H.323 framework 13 20 for voice over IP, SIP, comparison between H.323 ad SIP, Real time protocols, convergence technologies, call routing, call routing, voice over IP applications, IMS, Mobile VoIP, Security issues in mobile Information security, security techniques and algorithms, security framework for mobile environment

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy
Week 1	Next Generation Networks (NGN) Vision, Scenarios and Advances NGN Networks : Perspectives and Advances Some Possible Scenarios Virtual International Congress	Power point presentation and Flipped videos
Week 2	Virtual Class Rooms e-Education and Experimental Laboratory Virtual Home Home Networks Automatic Tra?c and Car Driving Driving NGN Requirements on Technology and Management	Explicit Teaching

Week 3	ITU NGN Functional Architecture Proposed NGN Functional Architecture NGN Network Operator NGN Network Service Provider NGN Customer and CTE Network and Service Evaluation towards NGN	Explicit Teaching peer learning
Week 4	Fixed Network Evaluation Mobile Network Evaluation Internet Evaluation	Demo-Experimental design of Mobile network evaluation,Power point presentation
Week 5	Terminal Area Access Network Area Backhaul Network	Power point presentation Video presentation
Week 6	Area Core Transport Network Area Service Creation Area Network Control and Managerial Area Service Control and Management	Power point presentation, Flipped videos
Week 7	Advanced Technologies for Network and Service Management ITU and GSI NGN ETSI and TISPAN	Power point presentation
Week 8	NGN ATIS and NGN CJA and NGN TMF and NGOSS NGMN Alliance and NGMN	Explicit Teaching
Week 9	3GPP and LTE/SAE NGMN Alliance and NGMN 3GPP and LTE/SAE Spread-spectrum Technology	Collaborative Teaching – Seminar Self-Study Topic
Week 10	FHSS, DSSS, CDMA versus GSM Wireless data third generation networks	Power point presentation, Video presentation
Week 11	applications in 3G Wireless LAN WiFi v/s 3G Voice over Internet protocol and convergenc Voice over IP	Power point presentation, Flipped videos
Week 12	H.323 framework for voice over IP SIP comparison between H.323 ad SIP	Power point presentation, Flipped videos

Week 13	Real time protocols convergence technologies call routing	Power point presentation
Week 14	call routing, voice over IP applications IMS Mobile VoIP	Power point presentation, Flipped videos
Week 15	Security issues in mobile Information security security techniques and algorithms, security framework for mobile environment.	Explicit Teaching, Case Studies

REFERENCES:

1. Jingming Li Salina and Pascal Salina, Next Generation Networks, Prospective and Potentials , John Wiley and Sons, 2007.

2. Thomas Plavyk, Next generation Telecommunication Networks, Services and Management, Wiley IEEE Press Publications, 2012.

3. Eldad Perahia and Robert Stacey, Next Generation Wireless LANs, Cambridge University Press, 2008.

4. Monique J. Morrow, Next Generation Networks, CISCO Press, 2007

6.9 213CSE4103: VISUAL CRYPTOGRAPHY

213CSE4103	**VISUAL CRYPTOGRAPHY**	**L**	**T**	**P**	**X**	**C**
		3	0	0	0	3
Pre-requisite :NIL **Course Category :**Honors Elective **Course Type :**Theory						

COURSE OBJECTIVES:

- To understand the cryptography concept by Symmetrical key encryption which allows visual information (pictures, text, etc.) to be encrypted in such a way that the decryption can be performed by the human visual system, without the aid of computers.
- To encrypts the visual information to be sent at the sender in to two shares in (2, 2) model, in this two shares one act as a key for decryption and another as encrypted message (transparency), at the receiver end no computation is required it just required the stacking of the key and the encrypted message.
- To understand that decryption can be performed by the human visual system. This technique can be extended for (k, n) model, gray level and for color images

COURSE OUTCOMES:

CO1: Identify the need and importance of visual cryptography

CO2: Demonstrate the concept of steganography and digital watermarking

CO3: Understand the various cryptographic schemes

CO4: Discuss the procedures for constructing visual cryptographic schemes

CO5: Discuss about visual cryptography and share generation using color images

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

	PO'S												PSO'S	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S			M			L		S			S	S	
CO2		S			S			L			L		S	
CO3						M				S			S	
CO4									M			M	S	
CO5			M				M			M		M	S	

UNIT I: FUNDAMENTALS OF VISUAL CRYPTOGRAPHY

Introduction, history, visual cryptography Vs traditional cryptography, common issues in Visual Cryptography - Visual Secret Sharing scheme: Construction of Visual Secret Shares, Halftone VSS Construction Using Error Diffusion, Share structure. - Distribution of SIP and ABP: Generation of Halftone shares via Error Diffusion.

UNIT II: PRINCIPLES OF STEGANOGRAPHY

Principles of Steganography and Digital Watermarking and Their Applications. Secret Sharing-Introduction - History of Secret Sharing - Principle of Secret Splitting - Phases of Secret Sharing - Access Structures - Threshold Schemes - Shamirs Scheme, Applications.

UNIT III: VISUAL CRYPTOGRAPHY

Visual Cryptography-Introduction-History of Visual Cryptography - Construction of Visual Cryptography Schemes - Basis Matrices - Construction of 2-Out-of-2 Visual Cryptography Schemes - Construction of 2-Out-of-2 Visual Cryptography Schemes With Square Pixel Expansion - Construction of Visual Cryptography Schemes With Consistent Image Size.

UNIT IV: VISUAL CRYPTOGRAPHY SCHEMES

Visual Cryptography Schemes-Construction of 2-Out-of-N Visual Cryptography Schemes - Basis Matrices for 2-Out-Of-N Visual Cryptography Schemes - Construction of N-Outof-N Visual Cryptography Schemes - Basis Matrices For N-Out-of-N Visual Cryptography Schemes - Construction of K-Out-of-N Visual Cryptography Schemes - Basis Matrices for K-Out-of-N Visual Cryptography Schemes.

UNIT V: VISUAL CRYPTOGRAPHY FOR COLOR IMAGES

Color Superposition and Darkening Problem - Formal Models for Colored VCS - Models for B AND W VC and Color VC - Visual Cryptography Schemes for SC model, Applications of Visual Cryptography.

15 WEEK COURSE PLAN

Week	Lecture (3 hours)	Pedagogy

Week 1	Introduction, history, visual cryptography Vs traditional cryptography, common issues in Visual Cryptography - Visual Secret Sharing scheme: Construction of Visual Secret Shares.	PPT, Video Presentation, Demonstration
Week 2	Halftone VSS Construction Using Error Diffusion, Share structure. - Distribution of SIP and ABP: Generation of Halftone shares via Error Diffusion.	PPT, Problem Solving
Week 3	hPrinciples of Steganography and Digital Watermarking and Their Applications. Secret Sharing-Introduction - History of Secret Sharing - Principle of Secret Splitting - Phases of Secret Sharing - Access Structures.	PPT, Video Presentation
Week 4	Threshold Schemes -Naor and Shamir's Basic Visual Secret Sharing Scheme, Visual Cryptography-Introduction-History of Visual Cryptography	PPT, Flipped Learning
Week 5	Construction of Visual Cryptography Schemes - Basis Matrices - Construction of 2-Out-of-2 Visual Cryptography Schemes	demonstration
Week 6	Construction of 2-Out-of-2 Visual Cryptography Schemes With Square Pixel Expansion - Construction of Visual Cryptography Schemes With Consistent Image Size.	demonstration

Week 7	Visual Cryptography Schemes-Construction of 2-Out-of-N Visual Cryptography Schemes - Basis Matrices for 2-Out-Of-N, Visual Cryptography Schemes - Construction of N-Outof-N Visual Cryptography Schemes - Basis Matrices For N-Out-of-N Visual Cryptography Schemes	Demonstration, Problem Solving, PPT
Week 8	Construction of K-Out-of-N Visual Cryptography Schemes - Basis Matrices for K-Out-of-N Visual Cryptography Schemes.	PPT, Problem solving
Week 9	Visual Multiple Secret Sharing Schemes	PPT, Problem Solving
Week 10	Color Superposition and Darkening Problem	problem solving
Week 11	Formal Models for Colored VCS	Peer Learning , PPT
Week 12	Models for B and W VC and Color VC .	PPT, Flipped Learning
Week 13	Visual Cryptography Schemes for SC model	PPT
Week 14	Applications of Visual Cryptography	PPT, Case study
Week 15	Case study on model implementation	Case study

REFERENCES:

1. BorkoFurht, EdinMuharemagic and Daniel Socek, Multimedia Encryption and Watermarking , Springer,2007

2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education 3rd Edition, 2010

3. Jen-Shyang Pan, Hsiang-Cheh Huang and Lakhi C. Jain, Intelligent Watermarking Techniques, World Scientific,2007

4. JosefPieprzyk, Thomas hardjino and Jennifer Sebberry,Fundamentals of computer security, Springer International 2nd Edition,2004.