B.TECH

CURRICULUM

2021

SCHOOL OF COMPUTING

DEPARTMENT OF INFORMATION TECHNOLOGY

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

(DEEMED TO BE UNIVERSITY)

(UnderSection 3 of the UGC Act 1956)

AnandNagar, Krishnankoil - 626126.

Srivilliputtur, Virudhunagar (Dist.), TamilNadu, 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 INFORMATION TECHNOLOGY

VISION

To be a department of repute offering programmes in frontier areas of ITthrough quality education, research and imbibing societal values.

MISSION

1. To provide quality education through effective curriculum and innovative teaching.

2. To facilitate conductive learning environment for students and faculty to investigate knowledge.

3. To instill the ethical behavior and social responsibilities to provide sustainable information technology solutions

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1: The graduates will be successful IT professionals in their chosen areaand / or pursue higher studies.

PEO-2: The graduates will comprehend, analyze, design and create novelproducts and technologies that provide sustainable solutions.

PEO-3: The graduates will demonstrate multidisciplinary knowledge,personal and interpersonal skills and work as an effective team member with ethical standards.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO-1: Ability to identify, design and develop processes and systems for enterprises

PSO-2: Ability to identify, deploy and maintain the IT infrastructure based on the needs of the businesses

PSO-3: Practice and promote information technologies for societal needs

PROGRAMME OUTCOMES (POs)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **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.

3. **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.

4. **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.

5. **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.

6. **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.

7. **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**.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **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.

11. **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.

12. **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

ASO1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

ASO2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

ASO3. Communicate effectively in a variety of professional contexts.

ASO4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

ASO5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

ASO6. Identify and analyze user needs to take them into account in the selection, creation, integration, evaluation, and administration of computing-based systems.

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

DEPARTMENT OF INFORMATION TECHNOLOGY

B.TechIT-CURRICULUMSTRUCTURE

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

Foundation Core

S.No	Course Code	Course Name	Course Type (TC/PC/IC-T/IC-P)	Course Credits
1	211CSE1401	Problem Solving using Computer Programming	IC-T	3
2	211CSE1402	Python Programming	IC-T	3

Program core courses (52 credits)				
S.No.	**Course Code**	**Course Name**	**Course Type (TC/PC/IC-T/IC-P)**	**Course Credits**
1	212INT1401	Web Application Development	IC-P	4
2	212INT2301	Digital Logic and Design	IC-T	4
3	212INT2302	Operating Systems Concepts	IC-T	4
4	212INT2303	Data Structures and Algorithms	IC-T	4
5	212INT2304	Object Oriented Programming using Java	IC-T	4
6	212INT2305	Embedded Systems and Technology	T	3
7	212INT3302	Data Communications and Computer Networks	IC-T	4
8	212INT2306	Information Storage, Modelling and Retrieval	IC-T	4
9	212INT2307	Software Construction and Management	IC-T	4
10	212INT3303	Data Science and Data Visualization	IC-T	4
11	212INT1101	Computer Organization and Assembly Language Programming	T	3
12	212MAT2107	Discrete Mathematics	T	4
13	212INT2308	Artificial Intelligence	T	3
14	212INT2102	Cyber Security and Forensics	T	3

Program Elective Courses (24 credits)				
S.No.	**Course Code**	**Course Name**	**Course Type (T/PC/IC-T/IC-P)**	**Course Credits**
1	213INT1101	Augmented Reality and Virtual Reality	T	3
2	213INT1102	Object Oriented Analysis and Design	T	3
3	213INT1103	Enterprise Resource Planning	T	3
4	213INT1104	Software Project Management	T	3
5	213INT1105	Digital Marketing	T	3
6	213INT1106	Signals and Systems	T	3
7	213INT1107	Cyber Physical Systems	T	3
8	213INT1108	5G Networks	T	3
9	213INT1109	Edge Computing	T	3
10	213INT1110	Bio Informatics	T	3
11	213INT1301	Information Coding Techniques	IC-T	4
12	213INT1302	Digital Image Processing	IC-T	3
13	213INT1303	Parallel and Distributed Computing	IC-T	3
14	213INT1304	Statistics with R Programming	IC-T	4
15	213INT1305	Data Warehousing and Mining	IC-T	4
16	213INT1306	Big Data Analytics	IC-T	4
17	213INT1307	Full stack software Development	IC-T	3
18	213INT1308	Principles of Digital Signal Processing	IC-T	4
19	213INT1309	Information Security	IC-T	4
20	213INT1310	Blockchain Technology	IC-T	4
21	213INT1311	Neural Networks and Fuzzy Logic	IC-T	4
22	213INT1312	Soft Computing	IC-T	4
23	213INT1313	Deep Learning	IC-T	4
24	213INT1314	Web services	IC-T	3
25	213INT1315	Managing the cloud	IC-T	3
26	213INT1316	Robotic Programming	IC-T	4
27	213INT1317	Statistics Foundation of Data Science	IC-T	4
28	213INT2301	Data Analysis Using Python	IC-T	4
29	213INT2302	Principles of Compiler Design	IC-T	4
30	213INT2303	Programming with Open Source	IC-T	4

		Software		
31	213INT2304	Formal Language and Automata	IC-T	4
32	213INT2305	Speech and Natural Language Processing	IC-T	3
33	213INT2306	System Software	IC-T	4
34	213INT2307	Distributed Systems	IC-T	4
35	213INT2308	Service Oriented Architecture	IC-T	3
36	213INT2309	Real Time Systems	IC-T	3
37	213INT2310	Design and Analysis of Algorithms	IC-T	4
38	213INT2311	Component Based Technology	IC-T	4
39	213INT2312	C# and .NET Programming	IC-T	4
40	213INT2313	Mobile Application Development	IC-T	4
41	213INT2314	Software Quality Assurance	IC-T	3
42	213INT3301	Game Programming	IC-T	4
43	213INT3302	Multimedia and Computer Graphics	IC-T	4
44	213INT3303	Graph Theory	IC-T	4
45	213INT3304	Machine Learning	IC-T	4
46	213INT3305	Advanced DBMS	IC-T	4
47	213INT3306	Information Storage Management	IC-T	4
48	213INT3307	Bluetooth Technology	IC-T	4
49	213INT3308	Wireless Sensor Networks	IC-T	4
50	213INT3309	Industrial IoT	IC-T	4
51	213INT3310	Network Design Security and Management	IC-T	4
52	213INT3311	Mobile Networks	IC-T	4
53	213INT3312	High Performance Networks	IC-T	4
54	213INT3313	Cryptography and Network Security	IC-T	4
55	213INT3314	Cloud Computing	IC-T	4
56	213INT3315	Green Computing	IC-T	3
57	213INT3316	Mobile Communication and Computing	IC-T	4
58	213INT3101	Wireless Application Protocol	T	3
59	213INT3102	Computer Forensics	T	3
60	213INT3103	Social Network Analysis	T	3
61	213INT3104	Information Retrieval Techniques	T	3

University Elective Courses (16 credits)

S.No.	Course Code	Course Name	Course Type (TC/PC/IC-T/IC-P)	Course Credits
1	214INT1301	Web Programming	IC-T	3
2	214INT1302	Introduction To Information Security	IC-T	3
3	214INT1303	Essentials Of Information Technology	IC-T	3
4	214INT1304	R Programming	IC-T	3
5	214INT1305	Programming With C++ And Java	IC-T	3
6	214INT1306	IT in Business	IC-T	3
7	214INT2301	Big Data Analytics	IC-T	3
8	214INT2302	Information Theory & Coding	IC-T	3
9	214INT2303	Cyber Forensics	IC-T	3
10	214INT2304	Internet And Java	IC-T	3
11	214INT2305	Network Protocols	IC-T	3
12	214INT2306	Introduction To Storage Management	IC-T	3
13	214INT2307	Principles and Practices of Communication Systems	IC-T	3
14	214INT2308	Software Testing	IC-T	3
15	214INT2309	Embedded C Programming	IC-T	3
16	214INT2310	Embedded System Automation	IC-T	3
17	214INT2311	System on Chip Design	IC-T	3
18	214INT3301	High Speed Networks	IC-T	3
19	214INT3302	Multimedia coding and Communications	IC-T	3

Experiential core Courses (16 credits)

S.No.	Course Code	Course Name	Course Type (TC/PC/IC-T/IC-P)	Course Credits
1	215INT2201	Design Project – I	PC	3
2	215INT3201	Design Project – II	PC	3
3	215INT4201	Capstone Project	PC	10

Experiential Elective Courses (8 credits)				
S.No.	**Course Code**	**Course Name**	**Course Type (TC/PC/IC-T/IC-P)**	**Course Credits**
1	216INT2201	Industry Internship	PC	2
2	216INT2202	Industrial Training	PC	2
3	216INT2203	Competitive Programming	PC	1
4	216INT2204	Micro Project	PC	1
5	216INT3201	Community Service Project	PC	3

211CSE1401: PROBLEM SOLVING USING COMPUTERPROGRAMMING

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 andproblem-solving
- To make the students understand the concept of data representation in computers
- To make the students solve simple and complex problems through programmingconcepts

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 forthe problems

MAPPING OF COURSE OUTCOMES WITH PO, PSO:

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

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 Con- versions and

Binary Logic - Representation of Problem data in computer format - In- troducing 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 sim- ple algorithms for sort, search and similar algorithms – Organizing multiple datasets in problem domain to computer format – Working with Single dimensional, multidimen- sional 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 struc- tures – Unions – Applications

UNIT V

Representing and organizing large problem dataset – Files – Types - Modes - File oper- ations – 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 (bound- aries of problem)- Intro- duction to Problem Solv-ing – 4 Pillars of Prob- lem Solving (Decomposi- tion, Pattern Recognition, Data Representation, Algo- rithms)	Take Real life problems, Apply the four pillars in solving the prob- lems (Individual / Group Activity can be planned)	Case studies in the spe- cific domain of study (de- partment specific) Identify the boundaries of the prob- lem domain, find solu- tion applying the pillars ofproblem solving Examples: Car Parking problem Water scarcity problem
Week 2	Analysing and representing Algorithms and *flowcharts (Common Algorithms to discuss)	Finding Maxi- mum/Minimum Searching, Sorting (Algorithms & flowchart alone. No program)	Write algorithms for the problem chosen (Done in Week-1)
Week 3	Importance of program- ming in problem solving, Expressing Algorithms in Pseudocode	Practical expo- sure to computer and computer hardware, Intro- ducing operating system, applica- tion software and compilers	Convert all algorithms to Pseudocode for the problem (Done in Week-2)

Week 4	Introduction to Computa-tional thinking – Informa-tion 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 com-piler, compiler features and, working with basic datatypes	Analyse the proper data type and memory require-ment for the problem (Done in Week-4)
Week 6	Representation of Problem data in computer format	Accessing data di-rectly with com-puter 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 struc-tures to write sim-ple 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 do-main to computer format	Organizing mul-tiple datasets in problem do- main to computer format	Analyse multiple datasets and represent the same in program(Done in Week 4)
Week 9	Organizing multiple datasets in problem do-main to computer format	String operations, working with DMA, creating strings using DMA concepts	Wherever possible, apply dynamic memory creation instead of static in the prob-lem (Done in Wee 3-4,8)
Week 10	Decomposing complex problems to simple solu-tions	Simple decompo-sition using func-tions	Decompose the complex problems to simple pro-grams (Done in Week7)
Week 11	Decomposing complex problems to simple solu-tions	Decomposition with parameters and recursion	Decompose the complex problems to simple pro-grams (Done in Week7)
Week 12	Organizing complex and variable datasets in prob- lem domain to computerformat	Create com-plex 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 prob- lem domain to computerformat	Implementation of single Linked list	Write the programs inte-grating complex data struc-ture (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 inWeek 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, ThirdEdition 2018.
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill, ThirdEdition, 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

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 leveragingmodules

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

CO5: Understand Data processing, Validation, Visualization concepts in python withregex, 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	3	3									3	
CO2	3	3									3	
CO3	3	2	2								2	
CO4	3	3			3						3	3
CO5	3	2	2		3						2	3

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, Sim- ple 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, Dic- tionary Comprehensions, Dictionaries with Compound Values

UNIT III: Functions and Modules

Functions: Introduction, Defining Your Own Functions, Parameters, Function Docu- mentation, Keyword and Optional Parameters, Passing Collections to a Function, Vari- able 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, Han- dling 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 In- heritance Attribute Tree Construction Specializing Inherited Methods Class InterfaceTechniques 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, Matching at Beginning or End, Match Objects, Substituting, Splitting a String, Compiling Regular Expressions, Flags.
Numerical Analysis & Plotting: Numpy – Overview, Setup, Datatypes, Basic Op- erators, 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 Hacker-rank 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 Ver-sions, Installing Python, Envi- ronment Vari- ables, Executing Python from the Command Line	Access and perform operations on Open Source Environments like Raspberry Pi
	Strings in Python	Explicit Teaching/ Demon-stration	String functions and formatting	
	Language Com-ponents – Part 01: Simple if	Explicit Teaching	Indenting Re-quirements, the if Statement	
Week 2	Language Com-ponents – Part02: Relational and Logical Operators, Bit Wise Operators	Explicit Teaching/ Demon-stration	while Loop, break and con-tinue, for Loop	Provide programming solution for decision and looping problem scenarios
	Lists, Tuples	Explicit Teaching	Hands-on ses-sion for Lists and Tuples - methods and functions Hackerrank – Problem Solving Challenge	
Week 3	Sets, Dictionary	Explicit Teaching	Hands-on ses-sion for Sets and Dictionary - methods and functions	Create solutions for complex problem statements leveraging

	Comprehension	Explicit Teaching	List Comprehen-sion, Dictionary Comprehen-sion, Lambda, Hackerrank – Problem Solving Challenge	Python Data structures
Week 4	Functions	Explicit Teaching	Getting started with function oriented pro-gramming	Apply the buit-in and user defined functions tocreate efficient programs lever- aging Pythonmodules.
	Modules	Explicit Teaching	Modular Pro-gramming, Built-in Mod-ules	
Week 5	Exceptions	Explicit Teaching	Practicing pro-grams 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 State-ment Methods Inheritance	Explicit Teaching	Attribute Tree Construction Specializing Inherited Meth-ods, Class Interface Tech-niques Abstract Super Classes	Create Ob-ject Oriented Solution for solving appli-cation oriented problems
Week 7	Regular Expres-sions, Simple Character Matches, Spe-cial Characters, Character Classes, Quan-tifiers, 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 orEnd, Match Objects, Substi- tuting, Splittinga String, Com- piling 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 whichdivide evenly into n).
   If d(a) = b and d(b) = a, where a = b, then a and b are an amicable pair and eachof 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 theproduct 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 twoterms. 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 exceedfour 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 corre-sponding alphabetical position and then accumulating a sum based on the followingrules:
   (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 nameEg.
   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) = 28.732Note: 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 aredivisible by k.
   Example:
   Given k = 5, N = 10, the natural numbers less than or equal to 10 and divisible by5 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 effi- ciently.
   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 havea 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 26gives the corresponding magnetic character.
   Replace all the characters in the given string with its magnetic character, resultingin magnetic word.
   Note: If a character is changed to magnetic once, all its subsequents appearanceswill 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 ofunique 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 numbersto the right, then . (dot) is considered as even number. Else . (dot) is consideredas 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 modeof 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 teamcan 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 com-putational problem-solving focus, Wiley Publishers

PROGRAM CORE

212INT2301	DIGITAL LOGIC AND DESIGN	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Basic Electrical and Electronics Engineering						
Course Category	Basic Engineering						
Course Type	Integrated Course with Theory						
Objective(s)	• To understand different methods used for the simplification of Boolean Functions. • To design and implement combinational circuits. • To design and implement synchronous and asynchronous sequential circuits. • To study the fundamental of VHDL/ Verilog HDL.						
Course Outcome(s)							
CO1	Able to design Logic gates with multi functionality implementation of Boolean functions						
CO2	Write Program for combinational and sequential circuits like Multiplexers, Flip flops, Counters using VHDL language						
CO3	Analyze and develop Synchronous Sequential circuits						
CO4	Analyze and Design Asynchronous Sequential circuits						
CO5	Design the specified logic (simple electronic circuits) with CMOS/Memory and Implementation of Programming logics concepts						

Mapping of COs with Pos

COs	Program Outcomes												PSO		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1	3									3		
CO2		3								2				2	
CO3			2	3							3		3		
CO4			1	3		2		3							3
CO5			3										3		
	3	**3**	**2**	**3**	**0**	**2**	**0**	**3**	**0**	**2**	**3**	**0**	**3**	**2**	**3**

Course Topic(s)

UNIT 1 :BOOLEAN ALGEBRA AND LOGIC GATES

Binary Numbers-Boolean functions as sum if product and product of sum terms-Representation of Boolean function using Venn Diagram

UNIT 2: COMBINATIONAL LOGIC

Introduction to combinational circuits-Developing boolean functions from given logicdiagram-Designing logic diagram from given design objective-Types of Combinational Circuits-Writing Hardware Description Language for some combinational circuits

UNIT 3 :SEQUENTIAL LOGIC

Sequential Circuits-Analysis and design procedure-Flip Flops-Realization of one Flip Flop using other Flip Flops-Shift Registers & Counters-State Reduction & Assignment-HDL for

Sequential Logic Circuits- Realization of one flip flop over another-Introduction to circuits with flipflops- Writing Hardware Description Language for some sequential circuits

UNIT 4: ASYNCHRONS SEQUENTIAL LOGIC

Introduction to Asynchronous Circuit- Developing boolean functions from given logic diagram.

Designing logic diagram from given design objective-Hazards

UNIT 5 :MEMORIES AND LOGICAL PROGRAMMING

Classification of Memory- Techniques used to detect and correct errors- Programmable Logic Devices-Types

LIST OF EXPERIMENTS

1. Verification of Boolean expressions using digital logic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters, etc.
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices.
4. Design and implementation of parity generator / checker using basic gates and MSI devices.
5. Design and implementation of magnitude comparator
6. Design and implementation of application using multiplexers
7. Design and implementation of Flip-flops
8. Design and implementation of Shift registers
9. Design and implementation of Synchronous and Asynchronous counters
10. Coding combinational circuits using Hardware Description Language (HDL software required)
11. Coding sequential circuits using HDL (HDL software required)

Additional Experiments:

12) Error Detection and Correction using Hamming Code

TEXT BOOK

1. Morris Mano M, "Digital Design", Pearson Education, 5th edition, 2013.

REFERENCES

1. Charles H.Roth, Jr., "Fundamentals of Logic Design", Jaico Publishing House, 7th Edition, 2014.
2. Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, 2003.

Week	Lecture(3 Hours)	Practical (2 Hours)
Week 1	What is signed binary number? - Representation of signed binary number	Realization of Boolean Expressions using Digital Logic Gates
Week 2	Expressing boolean functions as sum of product and product of sum terms	
Week 3	Representing boolean functions using venn diagram	
Week 4	Introduction to combinational circuits Developing boolean functions from given logic diagram.	Verification of truth table for combinational circuits

	Designing logic diagram from given design objective	
Week 5	Types of Combinational Circuits	
Week 6	Writing Hardware Description Language for some combinational circuits	HDL coding for combinational circuits
Week 7	Introduction to Sequential Circuits- Developing boolean functions from given logic diagram. Designing logic diagram from given design objective. Reduction in states and assigning states.	Verification of truth table offlip flops and shift registers
Week 8	Realization of one flip flop over another Introduction to circuits with flipflops	
Week 9	Writing Hardware Description Language for some sequential circuits	HDL coding for Sequential Circuits
Week 10	Introduction to Asynchronous Circuit	Verification of truth table for Synchronous Sequential circuits
Week 11	Developing boolean functions from given logic diagram. Designing logic diagram from given design objective.	
Week 12	Hazards	
Week 13	Classification of Memory	Memory Decoding
Week 14	Techniques used to detect and correct errors	Error detecting and correcting codes
Week 15	Programmable Logic Devices-Types	Design of PLD

212INT1101	COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING	L	T	P	X	C
		3	0	0	0	3
Prerequisite	Nil					
Course Category	Program Core					
Course Type	Theory					
Objective(s)	To make acquainted the students about the functional units of computer and how each unit works along with the architectural and performance issues.					

Course Outcome(s)	
CO1	Examine functional units of computer, bus structure and the different addressing modes
CO2	Apply the knowledge of algorithms to solve arithmetic unit problems
CO3	Demonstrate single bus, multiple bus organization and pipelining concepts
CO4	Analyze the different types of memory like RAM,ROM, Cache memory and virtual memory concepts
CO5	Evaluate the various I/O interfaces like USB, PCI an SCSI
CO6	Create efficient algorithms for implementing the different arithmetic and logic operations by applying appropriate design strategies
CO7	Implement the different architecture and analyze its performance using logic circuit design

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1:

Different Functional Parts of a computer,Operations of a computer, Data transferring between different parts-Storing the data into the Memory and its Locations, Methods of data brought into different Instructions and execution-Types of Addressing Modes, Assembly Language programming – Input and Output operations of data

UNIT 2 :

Binary numbers Addition and Subtraction with different methods-Multiplication of Positive binary Numbers using signed and unsigned numbers-Division methods using different binary numbers

UNIT 3:

Fundamental Concepts of a computer organization, Execution of a Complete Instruction using Single Bus and Multiple Bus Organization- Data execution methods using the Pipelining concept-How errors are happening during the process of data and its types **UNIT 4:**

Random Access Memory and Read Only Memory concepts and its comparison-Different Memory (Cache and Virtual) system and its Performance-Managing all the different memories, Data storing system of ROM.

UNIT 5 :

Input and Output devices and functions-Accessing the memory directly for fast process-Different Input Output Interfaces comparison

List of Practical Components

1. Implementation of booth algorithm
2. Implementation of sequential circuit binary multiplier
3. Implementation of bit pair recording
4. Implementation of carry save addition
5. Implementation of Integer restoring division
6. Implementation of Integer Non restoring division
7. Implementation of twos complement addition
8. Implementation of twos complement subtraction

TEXT BOOK:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, Computer Organization, McGraw-Hill, 5th Edition 2012

REFERENCE BOOKS:

1. William Stallings, Computer Organization and Architecture – Designing for Performance, PHI pvt Ltd, 4th Edition, 2012.
2. David A.Patterson and John L.Hennessy, Computer Organization and Design: The hardware software interface, Morgan Kaufmann, 3rd Edition, , 2007.
3. John P.Hayes, Computer Architecture and Organization, McGraw Hill, 3rd Edition, 1998

Week	Lecture (3 Hour)
Week 1	Different Functional Parts of a computer,Operations of a computer, Data transferring between different parts
Week 2	Storing the data into the Memory and its Locations, Methods of data brought into different Instructions and execution
Week 3	Types of Addressing Modes, Assembly Language programming – Input and Output operations of data
Week 4	Binary numbers Addition and Subtraction with different methods
Week 5	Multiplication of Positive binary Numbers using signed and unsigned numbers
Week 6	Division methods using different binary numbers
Week 7	Fundamental Concepts of a computer organization, Execution of a Complete Instruction using Single Bus and Multiple Bus Organization
Week 8	Arranging of different units and Controlling methods, Data execution methods using the Pipelining concept
Week 9	How errors are happening during the process of data and its types
Week 10	Random Access Memory and Read Only Memory concepts and its comparison

Week 11	Different Memory (Cache and Virtual) system and its Performance
Week 12	Managing all the different memories, Data storing system of ROM.
Week 13	Input and Output devices and functions
Week 14	Accessing the memory directly for fast process
Week 15	Different Input Output Interfaces comparison

212INT2302	OPERATING SYSTEMS CONCEPTS	L	T	P	X	C
		3	0	2	0	4
Prerequisite	Computer Organization and Assembly Language Programming (212INT1101)					
Course Category	Program Core					
Course Type	Integrated Course with Theory					
Objective(s)	1. To learn the mechanisms of OS to handle processes and threads and their Communication 2. To learn the mechanisms involved in memory management in contemporary OS 3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols 4. To know the components and management aspects of concurrency management					

Course Outcome(s)	
CO1	Understand the basic characteristics of operating systems and to explore the various functions of UNIX and windows operating systems.
CO2	Understand the process management policies and apply FCFS, SJF and RR CPU scheduling algorithms to schedule the process for CPU.
CO3	Evaluate the requirement for process synchronization and coordination handled by operating system.
CO4	Apply bankers algorithm to avoid deadlocks in operating systems
CO5	Analyze the efficiency of memory management techniques, the algorithms for page replacement in virtual memory and disk scheduling..
CO6	Understand the goals of security in OS Domain and apply basiccryptography algorithms using programming languages
CO7	Implement the domain problems by applying various operating systems principles to minimize time and space complexity..

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION TO OPERATING SYSTEMS

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System

UNIT 2 : PROCESS SCHEDULING

Processes: Definition, Process Relationship, Different 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 multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT 3: PROCESS SYNCHRONIZATION AND DEADLOCK

Operations on Processes , Cooperating Processes , Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT 4 : MEMORY MANAGEMENT

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; 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 , Working Set , 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).

UNIT 5: FILE AND SECONDARY STORAGE MANAGEMENT

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), efficiency and performance.

List of Practical Components:

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

TEXT BOOKS :

1. Abraham Silberschatz, Peter Galvin,Greg Gagne, “Operating System Concepts and Essentials”, 9th Edition, Wiley Asia Student Edition.
2. William Stallings, “Operating Systems: Internals and Design Principles”, 5th Edition, , Prentice Hall of India.

REFERNCE BOOKS

1. Charles Crowley, “Operating System: A Design-oriented Approach”, 1st Edition by, Irwin Publishing.
2. Gary J. Nutt, “Operating Systems: A Modern Perspective”, 2nd Edition, 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

Week	Lecture (3 Hour)	Practical (2 Hours)
Week 1	Introduction: Concept of Operating Systems, Generations of Operating systems	Windows and UNIX Commands
Week 2	Types of Operating Systems, OS Services, System Calls	
Week 3	Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System	Simulation of System calls
Week 4	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Operations on Processes	Implementation of FCFS and SJF Scheduling algorithms
Week 5	Cooperating Processes , Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads	
Week 6	**Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF	Implementation of Round robin and Priority Scheduling algorithms
Week 7	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson’s Solution,	Simulation of IPC in UNIX
Week 8	The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader’s & Writer Problem, Dinning Philosopher Problem etc	Implementation of Readers writers problem
Week 9	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker’s algorithm, Deadlock detection and Recovery	Implementation of deadlock avoidance algorithms

Week 10	**Memory Management**: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction	Implementation of memory management functions
Week 11	Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.	Implementation of Page replacement algorithms
Week 12	**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , 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).	
Week 13	**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	Implementation of disk scheduling algorithms
Week 14	Disk formatting, Boot-block, Bad blocks **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure	Implementation of Access control mechanisms
Week 15	Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Protection and Security	Implementation of security algorithms

212INT1401	WEB APPLICATIONDEVELOPMENT	L	T	P	X	C
		2	0	2	3	4
Prerequisite	Nil					
Course Category	Program Core					
Course Type	Integrated Course with Practical					
Objective(s)	• To learn the theoretical and practical concepts of web programming. • To introduce the programming languages for developing simple web applications. • To make students to understand about the architecture of web server and deployment of web site • To teach methodologies useful for the implementation of dynamic web applications • To efficiently design and implement web applications using server side programming languages					
Course Outcome(s)						
CO1	Apply frontend web development concepts in designing static pages.					
CO2	Apply frontend web development concepts in deigning dynamic pages.					
CO3	Develop web server incorporating multimedia features.					
CO4	Develop dynamic server based applications through ASP.					
CO5	Apply database concepts in storing and managing data generated through web applications					

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2			2						3			2
CO2	2	2	3					2				3			2
CO3			3		2	2						3		3	2
CO4		3	3		3			2				3	3	2	
CO5	2	2	2		2			2				3	3	2	
	2	**2**	**3**		**2**	**2**	**2**	**2**				**3**	**3**	**2**	**2**

Course Topic(s)

UNIT – I (Web Basics and HTML)

History of Internet and W3C – Internet Protocols – HTTP Request and Response – HTTP Message Header Types – HTML (5): Basic Tags – Metadata Tags – Section Tags – Grouping Tags – Text Formatting Tags – Embedded Content Tags – Multimedia – Tables – Forms

UNIT – II (Dynamic HTML, Client Scripting and CSS)

JavaScript: History – Syntax – variables – data types – operators - control structures –

functions – arrays - objects – events - ajax; CSS: Inline, Embedded and External style sheets – positioning elements – backgrounds – element dimensions – box model and flow model

UNIT –III (Server Side Scripting using ASP.NET with .NET Framework)

ASP.NET Introduction – Server Controls: HTML Server Controls - ASP.NET Web Controls – Validation controls – List – User Controls – State Management: Client Side state management - Server Side state management- ASP.NET Ajax Controls - URL Rewriting - Working with XML documents – IIS

Unit – IV (Accessing Database)

ADO.NET – Connecting Database – Performing CURD operations with SqlCommand, SqlDataReader objects – Disconnected Database - Working with stored procedures – SQL Injection Attacks and prevention

Unit – V (Web Services and Security)

Web Services: WSDL – SOAP – RDF – RSS – Web Security Issues: Broken Authentication and Session Management - Sensitive Data Exposure - XML External Entities (XXE) - Broken Access Control - Security Misconfiguration - Cross-Site Scripting XSS

TEXT BOOK

1. Deitel&Deitel, Goldberg, "Internet and World Wide Web 5th Edition – How to Program", Pearson Education Asia, 2012.

REFERENCES

1. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA1.2", Prentice Hall of India, QUE, 1999.
2. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.
3. Rajkamal, "Web Technology", Tata McGraw-Hill, 2001.

Lab experiments:

1. Familiarizing Web Applications and browsers – Web portals, e-commerce, blogs, social media, etc.
2. Working with basic HTML Tags
3. Working with tables and Form Elements
4. Create a profile page in Google Sites
5. Java Scripts
    a. Registration Form with Table
    b. String, Math & Date Object's predefined methods
    c. Calendar Creation : with all months
    d. Event Handling - Validating Simple Form
    e. Event Handling - Multi-Validating Registration Form
    f. Event Handling - Background Color Change
    g. Event Handling - calendar for the month and year by combo box
    h. Event Handling - OnMouseover event
    i. Event Handling - OnMouseover using objects
    j. Online Exam a Mini Project

6. Understanding .NET IDE for ASP Application Development
7. IIS Installation and Study
8. ASP.NET Application for Form validation
9. ASP.NET application for state management
10. ASP.NET application with ajax controls
11. Use ADO.NET for DB Connection with ASP.NET application
12. Working with disconnected databases in ASP.NET
13. Working with stored procedures
14. Create a mini project with ASP.NET application will all technologies and security concerns.

Week	Lecture (2 Hour)	Practical (2 Hours)	X-Component (3 Hours)
Week 1	History of Internet andW3C – Internet Protocols – HTTP Request and Response – HTTP Message Header Types	Familiarizing Web Applications and browsers – Web portals,e-commerce, blogs, social media, etc.	Create a profile page in Google Sites --Include Name and public personal details --Include photo --Include About Yourself --Your expertise and achievements --Your strengths --Photo gallery -- Any specific interests
Week 2	HTML5: Basic Tags – Metadata Tags – Section Tags – Grouping Tags – Text Formatting Tags	Working with basic HTML Tags	
Week 3	Embedded Content Tags – Multimedia – Tables – Forms	Working with tables and Form Elements	
Week 4	JavaScript: History – Syntax – variables – data types – operators - control structures	Event Handling - Validating Simple Form Event Handling - Background Color Change Event Handling - OnMouseover event Event Handling - OnMouseover using objects	Simple game using JS and CSS tricks
Week 5	functions – arrays - objects – events - ajax	b. String, Math & Date Object's predefined methods	
Week 6	CSS: Inline, Embedded and External style sheets – positioning elements – backgrounds – element dimensions – box model and flow model	Calendar Creation : with all months	
Week 7	ASP.NET Introduction – Server Controls: HTML Server Controls - ASP.NET Web Controls – Validation controls – List – User Controls, IIS	Understanding .NET IDE for ASP Application Development ASP.NET Application for Form validation	Installing and configuring IIS
Week 8	State Management: Client Side state management -	ASP.NET application for state management	Mini Project – Form Designing and

	Server Side state management		validation
Week 9	ASP.NET Ajax Controls - URL Rewriting - Working with XML documents	ASP.NET application with ajax controls	
Week 10	ADO.NET – Connecting Database – Performing CURD operations with SqlCommand, SqlDataReader objects	Use ADO.NET for DB Connection with ASP.NET application	Use the Mini project to connect with database and do DB operations
Week 11	Disconnected Database	Working with disconnected databases in ASP.NET	
Week 12	Working with stored procedures – SQL Injection Attacks and prevention	Working with stored procedures	
Week 13	Web Services: WSDL – SOAP – RDF – RSS	Implement WSDL – SOAP – RDF – RSS in the Mini Project	Case study of WSDL – SOAP – RDF – RSS with different platforms
Week 14	Web Security Issues: Broken Authentication and Session Management - Sensitive Data Exposure - XML External Entities (XXE)	Add appropriate security measures for the attacks	Test the Mini Project for these specific attacks. Try to resolve it.
Week 15	Broken Access Control - Security Misconfiguration - Cross-Site Scripting XSS, RCE	Add appropriate security check for XSS, RCE etc.	Test the Mini Project for these specific attacks. Try to resolve it.

212INT2303	DATA STRUCTURES AND ALGORITHMS	L	T	P	X	C
		3	0	2	0	4
Prerequisite	Python for Programming and Product Development (211CSE1401)					
Course Category	Program Core					
Course Type	Integrated Course with Theory					
Objective(s)	• To learn the systematic way of solving problems. • To understand the different methods of organizing large amounts ofdata. • To introduce the practical and formal aspects of data structures • To teach methodologies useful for the implementation and empirical evaluation of sorting and searching algorithms. • To efficiently implement the solutions for specific problems using data structures					
Course Outcome(s)						
CO1	Implement different Linear Data structures in different applications					
CO2	Design real time applications using general tree data structures and compare its complexity					
CO3	Illustrate the various operations of hashing techniques and sorting algorithms,					
CO4	Identify proper algorithms for problem optimizations					
CO5	Implement the various algorithms - design techniques.					
CO6	Design an efficient algorithm for real time problem					
CO7	Implement the problem statements in programming languages and analyze its efficiency.					

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1								2	3		
CO2	3	3	2	3			1					2	3		
CO3	3	3	2	3								2	3		
CO4	2	2	2	3								2	3		
CO5	2	2	2	3								2	3		
CO6	3	2	3	2	1			2	3	3		2	2	3	3
CO7	3	2	3	2	2			3	3	3		3	1	3	3
	3	**2**	**2**	**2**	**2**		**1**	**3**	**3**	**3**		**2**	**3**	**3**	**3**

UNIT 1: LINEAR STRUCTURES

Abstract Data Types (ADT)-List ADT- Array based implementation- linked list implementation-Cursor based linked lists-Doubly linked lists- Applications of lists- stack ADT- Queue ADT-Circular queue implementation- Applications of stacks and queue.

UNIT 2: TREE STRUCTURES

Tree ADT- Tree Traversals Binary Tree ADT – Express trees Application of trees- binary search tree ADT- Threaded Binary Trees. AVL Trees – Splay Trees – B –Tree – heaps – Binary heaps – Applications of binary heaps

UNIT 3 : HASHING AND SORTING

Hashing- Separate chaining – open addressing – rehashing – extendible hashing – Sorting – Insertion Sort – Selection Sort -Shell Sort – Heap Sort – Merge Sort – Quick Sort

UNIT 4 : GRAPHS

Graph Definitions and types, Graph Representation -topological sorting – breadth first traversal – shortest path algorithm – minimum spanning tree – Prims and Kruskal's algorithm – Depth first traversal- biconnectivity- Euler circuits – Applications of graphs

UNIT 5: ALGORITHM DESIGN TECHNIQUES

Introduction – Greedy Method- Divide and Conquer – Dynamic Programming- Back Tracking-Branch and Bound.

PRACTICE COMPONENTS

1. Write a program to implement Stack Using Array and Linked list.
2. Write a program to implement Queue Using Array and Linked list.
3. Write a program to create a singly linked list.
4. Develop a date structure for trees, Include addition, deletion, access procedures. Apply this to problems like students list, passengers list, and polynomial representations.
5. Write a program to implement Binary Search Tree.
6. Write a program to implement Conversion of Infix Expression to Postfix Expression.
7. Write a program to implement Conversion of Postfix Expression to Infix Expression.
8. Write a program to implement Postfix Expression Evaluation.
9. Write an algorithm to convert a tree into a binary tree. Also traverse the tree.
10. Write a program to check for balanced parentheses of an expression using array implementation of stack.
11. Write a program to check for balanced parentheses of an expression using linked list implementation of stack.
12. Write a program to sort a set of elements using bubble sort, insertion sort, shell sort, heap sort, merge sort and quick sort.
13. Write a C program to implement the Dijkstra's Algorithm
14. Write C program for the implementation of minimum spanning using Kruskal

Write C program for the implementation of minimum spanning using Prims algorithm

TEXT BOOK

1. M.A.Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson Education, 2013.

REFERENCES

1. A.V.Aho, J.E.Hopcroft and J.D.Ullman, "Data Structures and Algorithms", Pearson Education, 2005.
2. R.F.Gilberg, B.A.Forouzan, "Data Structures", Second Edition, Thomson IndiaEdition, 2005.

Week	Lecture (2 Hour)	Practical (2 Hours)	X-Component (3 Hours)
Week 1	Abstract Data Type(ADT)- List ADT- Array Based implementation- Linked List implementation	Create linear list using array and linked list	Need to provide programming solution using array and pointers
Week 2	Cursor based Linked List- Doubly Linked List- Application of Lists- Stack ADT	Creation of Doubly linked- polynomial representation using doubly linked. Write a program to implement a Stack using an array and pointers	(i) Absolute sorting on a single linked list. (ii) Intersection Point in Y-Shaped Linked List (iii) Sum of two numbers represented by linked lists
Week 3	Queue ADT- Circular queue implementation- Application of Stack and Queue	Write a program to implement a Queue using an array and pointers. Write a program to create a singly linked list Write a program to implement postfix evaluation. Write a program to checkfor balanced parentheses of an expression using array implementation of stack. Write a program to checkfor balanced parentheses of an expression using pointers implementation of stack	Understand and develop computationally efficient solution for the Problems using Data Structures, like (i) stock span problem(ii) Given a pattern containing only **I's** and **D's**. **'I'** stands for increasing and **'D'** for decreasing. Devise an algorithm to print the minimum number following that pattern. Digits are from **1-9** and digits can't repeat.
Week 4	Tree ADT -Tree Traversals Binary Tree ADT	Develop a date structure for trees, Include addition, deletion, access procedures. Apply this to problems like students list, passengers list, and polynomial representations.	Develop a date structure for trees, Include addition, deletion, access procedures. Apply this to problems like students list, passengers list.
Week 5	Expression tree and Application of Tree- Threaded binary tree- AVL Trees	Write a program to implement Binary Search Tree.	Need to provide programming solution for AVL tree and Splay tree problem scenarios.
Week 6	Splay Trees – B –Tree – heaps – Binary heaps – Applications of binary heaps	Write an algorithm to convert a tree into a binary tree. Also traverse the tree.	
Week 7	Hashing- Separate chaining – open addressing	Implementation of separate chaining.	Design and implementation Hashing using open addressing
Week 8	rehashing – extendible hashing – Sorting – Insertion Sort	Write a program to sort a set of elements using bubble sort, insertion sort	Comparison of searching and sorting algorithms.
Week	Selection Sort -Shell Sort –	Write a program to sort a	

9	Heap Sort – Merge Sort – Quick Sort	set of elements using, shell sort, heap sort, merge sort and quick sort	
Week 10	Graph Definitions and types, Graph Representation - topological sorting	Graph Representation - topological sorting	Alien Dictionary problem-i.e-Given a sorted dictionary (array of words) of an alien language, find order of characters in the language. (ii) Rotten Oranges-Given a matrix of dimension r*c where each cell in the matrix can have values 0, 1 or 2 which has thefollowing meaning: • 0 : Empty cell • 1 : Cells have fresh oranges • 2 : Cells have rotten oranges So, we have to determine what is the minimum time required to all oranges. A **rotten orange** at index [i,j] can rot other fresh orange at indexes [i-1,j], [i+1,j], [i,j-1], [i,j+1] (up, down, left and right) in unit time. If it is impossible to rotevery orange then simply return -1.
Week 11	breadth first traversal – Depth first traversal shortest path algorithm –	BFS and DFS , shortest path algorithm	Design and implement graph Representation. Also demonstrate programs implementing Graph traversal techniques. Shortest Source to Destination Path-Given a Boolean 2D matrix (0-based index), find whether there is a path from **(0,0)** to **(x,y)** and if there is one path, print the minimum no of steps needed to reach it, else print -1 if the destination is not reachable. Moves are possible in only four directions i.e. up,

			down, left and right. The path can only be created out of a cellif its value is 1.
Week 12	minimum spanning tree – Prims and Kruskal's algorithm - biconnectivity- Euler circuits – Applications of graphs	minimum spanning tree – Prims and Kruskal's	(i) Knight walk problem-There is a chessboard of size N×M and starting position (sx, sy) and destination position (dx,dy). You have to find out how many minimum numbers of moves a knight goes to that destination position? (ii) PPATH - Prime Path Problem-You are given two prime numbers n and m of 4 digits each, you need to convertn into m in the minimum number of steps, in each step you can change one of the digits of thenumber n such that a resulting number is also a prime number. Finally, give the number of minimum steps that you would take to complete the task if you can't change n to m then print "Impossible".
Week 13	Introduction – Greedy Method-	Knapsack Problem	Understand and develop computationally efficient solution for the Problems using Algorithm design Techniques
Week 14	Divide and Conquer – Dynamic Programming	Tower of Hanoi and Implement the Dijkstra's algorithm, Huffman encoding techniques	
Week 15	Back Tracking- Branch and Bound.	Eight Queen problem	

212MAT2107	DISCRETE MATHEMATICS	L	T
		3	0
Prerequisite	Nil		
Course Category	Program Core		
Course Type	Theory		
Objective(s)	To enable the students to understand the concept of sets, relations, functions, logic and algebraic structure		
Course Outcome(s)			
CO1	Understand the concepts of Cartesian product,binary operation, partially order, relation, function andits properties.		
CO2	Know about the pigeon-hole principle, inclusion and exclusion principles, tautology and normal forms.		
CO3	Understand the concepts of lattice, homomorphism,modular and distributivelattices.		
CO4	Understand the concepts of semigroup, group, Boolean algebra, Booleanring and duality.		
CO5	Understand the concepts in graph theory such as walk, cycle,path, trees,Hamiltonian and Eulerian graphs.		

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											2		
CO2	3	3											3		
CO3	3			3	2	1							3	2	
CO4	3			3	2	1							3	2	
CO5	3	3			2								3		
	3	**3**	**0**	**3**	**2**	1	**0**	**0**	**0**	**0**	0	**0**	**3**	**2**	**0**

Week	Lecture (3 Hour)	Practical (1 Hours)
Week 1	Principle of Inclusion-Exclusion, Some operations ofrelations	Matlab Programs to understand types of relations
Week 2	Compositions of Relations, Types of Relations, Equivalence classes	Matlab programs to find equivalence classes
Week 3	Functions – one-to-one – onto, Composition of functions– Inverse of a function.	Matlab for functions, inverse of functions
Week 4	Propositions – Connectives, Tautology and contradiction	Matlab for Tautology and Contradiction
Week 5	Algebra of propositions, Conditional and bi-conditional propositions	Matlab for Algebra of Propositions
Week 6	Tautological implications ,Normal Forms, Disjunctive and conjunctive normal forms	Matlab for Disjunctive and

		conjuctive normal forms
Week 7	Principal disjunctive normal forms, Principal conjunctive normal forms	Matlab for PCNF and PDNF
Week 8	Permutations, Combinations	Matlab for Permutations and combinations
Week 9	Recurrence relations, Particular solutions, Solutions of recurrence relations using generating functions	Matlab for generating functions
Week 10	Lattices, Properties of Lattices	Matlab for Lattices
Week 11	Lattices as algebraic system, Sub lattices	Matlab for Lattices as algebraic system
Week 12	Boolean algebra, Additional properties of Boolean algebra.	Matlab for Boolean Algebra
Week 13	Basic definitions – Degree of a vertex – Some special simple graphs, Matrix representation of graphs	Matlab for degree of a vertex
Week 14	paths, cycles and connectivity – Eulerian and Hamiltonian graphs, Connectedness in directed graphs	Matlab for verifying Eulerian and Hamiltonian graphs
Week 15	Trees – Spanning trees, Prim’s algorithm – Kruskal’s algorithm.	Matlab for Prim's algorithm and Krushkals algorithm

212INT2304	Object Oriented Programming Using Java	L	T	P	X
		2	0	2	3
Prerequisite	Python for Programming and Product Development (211CSE1401)				
Course Category	Program Core				
Course Type	Integrated Course with Theory				
Objective(s)	• To understand the basic Java Programming skills and object oriented programming concepts • To know the working nature of Inheritances, Packages and Interfaces • To examine the errors and to find the solution using Exception Handling and threads • To apply the event handlers in the real time scenarios • To develop applications using Graphical User Interfaces • To aggregate the advanced Java skills of Swings • To develop web applications using Java Applets				
Course Outcome(s).					
CO1	Know the basic knowledge and programming skills of object oriented programming in Java				
CO2	Apply the Inheritance, package and interface concepts of Java to develop the elevated applications				
CO3	Apply the concepts of Multithreading and Exception handling to developefficient and error free codes.				
CO4	Design event driven GUI and web related applications which mimic the real word scenarios.				
CO5	Able to develop interactive programs using applets and swings				
CO6	Propose the use of certain technologies by implementing them inthe Java programming language to solve the given problem.				
CO7	To design and develop the stand-alone applications as a team				

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3			2		2	2				2		2	2	3
CO2	2	2		3								1	3	2	2
CO3				3	3								3	2	
CO4				2		3	3	2		2	2				
CO5	2	2	2	2			3		1						2
CO6										3					
CO7									3		3				
	3	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**3**

UNIT I: OOP Basics

JAVA BASICS: Review of Object oriented concepts, History of Java, Java buzzwords, JVM architecture, Data types- Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors- methods, Static block, Static Data, Static Method, String and String Buffer Classes, Using Java API Document.

UNIT II: Inheritance, Packages and Interfaces

Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading.- Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. Defining package, Access protection, importing packages; Defining and Implementing interfaces, and Extending interfaces.

UNIT III: Exception Handling, I/O and Multithreading

Concepts of Exception Handling - Benefits of Exception Handling Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords- Built-in Exceptions, Creating own Exception classes, Input/Output: The I/O Classes and Interfaces, I/O Exceptions, Stream classes,Concepts of Thread, Thread life cycle- creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication

UNIT IV: Event Handling

Events: Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes; **AWT:**The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Managers – Flow Layout, Border Layout, Grid Layout and Card Layout, Menu Bars and Menus.

UNIT V: GUI Programming with Swing

Swing: Introduction, Limitations of AWT, MVC Connection, Components and Containers, **Exploring Swing**:JLabel and ImageIcon, JTextField, The Swing Buttons- JButton, JToggleButton, Check Boxes and Radio Buttons, JTappedPane, JScrollPane, JList, JComboBox, Trees and JTable.**Introducing Swing Menus**- Menu Basics, Overview of JMenuBar, JMenu and JMenuItem, Create a Main Menu.

S.No	Experiments
1	Basic Java Programming
2	Programs using Objects and Classes
3	Programs using Array and String
4	Programs using Static data, Static block and Static Method
5	Programs using Inheritance
6	Programs using Interface
7	Programs using Exception Handling
8	Programs using Stream Classes
9	Programs using Multithreading
10	Programs using Event Handling
11	Programs using AWT
12	Programs using Swings and Swing Menus
13	Additional Experiments if any

TEXT BOOK

1. HerbertSchildt,TheCompleteReference-Java,TataMcGraw-HillEducation,TenthEdition,2017

2. PaulJ. Deitel, HarveyDeitel ,Java SE8forProgrammers (Deitel Developer Series) 3rd,Edition, 2014
3. Y.DanielLiang, IntroductiontoJavaprogramming-comprehensiveversion-TenthEdition,Pearsonltd 2015
4. E.Balagurusamy. “Programming with JAVA” A primer, Tata McGraw Hill Publication company, fourth edition, 2010

REFERENCES

1. PaulDeitel HarveyDeitel, Java - How to Program,PrenticeHall;9th edition, 2011.
2. CayHorstmannBIG JAVA,4th Edition,JohnWileySons,2009
3. NicholasS.Williams,ProfessionalJava forWebApplications,Wrox Press,2014
4. T. Budd (2009), An Introduction to Object Oriented Programming, Addison Wesley Longman, 2002

Course Chart: **#Weeks**	**Lecture (3 Hours)**	**Pedagogy**	**Practical (2 Hours)**	**Pedagogy**
Week 1	JAVA BASICS: Review of Object oriented concepts, History of Java,	Explicit Teaching	Disseminate with Java Compiler and OOPS concepts	Study Experiment
	Java buzzwords, JVM architecture	Explicit Teaching		
	Data types- Variables, Scope andlife time of variables	PPT		
Week 2	Arrays and operators	PPT	Hands on session for Basic Java Programming	Demonstration
	Control statements	Explicit Teaching		
	Type conversion and casting, simple java program	Explicit Teaching		
Week 3	Constructors- methods	PPT	Hands on session for Objects and Classes	Demonstration
	Static block, Static Data, Static Method	Explicit Teaching		
	String and String Buffer Classes, Using Java API Document.	Explicit Teaching		
Week 4	Basic concepts, Types of	PPT	Hands on	Demonstration

Course Chart: #Weeks	Lecture (3 Hours)	Pedagogy	Practical (2 Hours)	Pedagogy
	inheritance		session for Array and String	
	Member access rules	Explicit Teaching		
	Usage of this and Super key word			
Week 5	Method Overloading.- Method overriding, Abstract classes,	PPT	Hands on session for Static data, Static block and Static Method	Demonstration
	Dynamic method dispatch	Explicit Teaching		
	Usage of final keyword.	PPT		
Week 6	Defining package, Access protection	PPT	Hands on session for Inheritance	Demonstration
	Importing packages	PPT		
	Defining and Implementing interfaces, and Extending interfaces.	Explicit Teaching		
Week 7	Concepts of Exception Handling - Benefits of Exception Handling Exception types	Explicit Teaching	Hands on session for Interface	Demonstration
	Usage of Try, Catch, Throw, Throws and Finally keywords	Explicit Teaching		
	Built-in Exceptions	PPT		
Week 8	Creating own Exception classes	PPT	Hands on session for Exception	Demonstration
	Input/Output: The I/O Classes and Interfaces	PPT		

Course Chart: **#Weeks**	**Lecture (3 Hours)**	**Pedagogy**	**Practical (2 Hours)**	**Pedagogy**
	I/O Exceptions, Stream classes	Explicit Teaching	Handling	
Week 9	Concepts of Thread, Thread lifecycle	PPT	*Mid-semester practical examination-I*	
	creating threads using Thread class and Runnable interface	PPT		
	Synchronization, Thread priorities, Inter Thread communication	Explicit Teaching		
Week 10	**Events:** Event Sources, Event Classes,	PPT	Hands on session for Stream Classes	Demonstration
	Event Listeners, Delegation Event Model,	PPT		
	Handling Mouse and Keyboard Events, Adapter Classes	Explicit Teaching		
Week 11	**AWT:** The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas	PPT	Hands on session for Multithreading	Demonstration
	Scrollbars, Text Components, Check Box, Check Box Groups	Explicit Teaching		
	Choices, Lists Panels – Scrollpane	Explicit Teaching		
Week 12	Dialogs, Menubar, Graphics, Layout Managers – Flow Layout,	PPT	Hands on session for	Demonstration

Course Chart: **#Weeks**	**Lecture (3 Hours)**	**Pedagogy**	**Practical (2 Hours)**	**Pedagogy**
	Border Layout, Grid Layout andCard Layout	PPT	Event Handling	
	Menu Bars and Menus.	Explicit Teaching		
Week 13	**Swing:** Introduction, Limitations of AWT	PPT	Hands on session for AWT	Demonstration
	MVC Connection	PPT		
	Components and Containers	PPT		
Week 14	**Exploring Swing**: JLabel and ImageIcon, JTextField, The Swing Buttons- JButton, JToggleButton	Explicit Teaching	Hands on session for Swings and Swing Menus	Demonstration
	Check Boxes and Radio Buttons, JTappedPane, JScrollPane	PPT		
	JList, JComboBox, Trees and JTable.	PPT		
Week 15	**Introducing Swing Menus**- Menu Basics	PPT	*Mid-semester practical examination-II*	
	Overview of JMenuBar, JMenu and JMenuItem	Explicit Teaching		
	Create a Main Menu.	Explicit Teaching		

212INT2305	EMBEDDED SYSTEM TECHNOLOGY	L	T	P	X	C
		2	0	2	0	3
Prerequisite	Digital Logic and Design(212INT2301)					
Course Category	Program Core					
Course Type	Integrated Course with Theory					
Objective(s)	• To introduce the Significance and the role of embedded system for automation. • To understand the embedded system role in IOT and use it for application development. • To observe the need for smart cities and systems • To introduce the automotive embedded systems • To observe the evolving trend in communication based automotive systems.					

Course Outcome(s)	
CO1	Ability to understand hardware and software requirements in embeddedsystems.
CO2	Ability to do develop data management through cloud interface withprocessor technology
CO3	Learn the development smart system solutions and analyse issues.
CO4	Ability to understand the types of sensors and Bus for controlimplementation.
CO5	Capacity to involve communication concepts for vehicle application development.

Mapping of COs with Pos

COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3											3		
CO2		3	2		3								2		
CO3		3	2		2		3				1			2	
CO4		2			2						1		2		
CO5									3					3	
	1	**3**	**2**	**0**	**2**	**0**	**3**	**0**	**3**	**0**	**1**	**0**	**2**	**3**	**0**

Course Topic(s)

UNIT I EMBEDDED SYSTEMS DESIGN

Overview of Embedded system - Design process in embedded system- CommunicationProtocols Embedded SOC- RTOS- Embedded product Development Life Cycle.

UNIT II INTRODUCTION TO 8051 MICROCONTROLLER

Introduction-8051 Architecture- Memory Organization- Internal RAM Structure- Stack Operation- Addressing Modes- Instruction Set- Assembler Directives; Assembly Language Programming Examples.

UNIT III 8051 HARDWARE AND INTERFACE

8051 Hardware- Introduction, Parallel ports, External Memory Interfacing- Program and Data Memory; Timers and Counters, Interrupts, Serial ports; 8051 Interface- Interfacing 8255 with 8051, 7-Segment display, Interfacing ADC and DAC, Interfacing Stepper Motor, Traffic Light Control.

UNIT IV EMBEDDED SYSTEM FOR IOT

Overview of IOT- Sensing- Actuation- IOT Networking- Communication protocols-data handling and analytics- cloud computing- Implementation of IOT with Raspberry pi- Industrial IOT.

UNIT V EMBEDDED SYSTEMS AND IOT APPLICATIONS

Embedded system for Smart Meter- smart Grid -Smart cities and smart homes, Agriculture and Healthcare, Energy auditing.

TEXT BOOKS:

1. Peckol, "Embedded system Design",JohnWiley&Sons,2010
2. William B. Ribbens, Understanding Automotive Electronics, 6th edition, YES DEE Publishing Private Limited, 2011.
3. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", byPethuru Raj and Anupama C. Raman (CRC Press), 1st Edition , 2017

REFERENCES:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011
2. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill,2007.
3. Mehrdad Ehsani, 'Modern Electric, Hybrid Electric and Fuel cell vehicles', CRCPress Second edition 2011

Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press) Research papers, 2014.

Week	Lecture (3 Hour)	Practical (1 Hours)
Week 1	Embedded systems, processor embedded into a system, embedded hardware units and devices in a system, embedded software in a system, examples of embedded systems	Installing of embedded software
Week 2	embedded SOC and use of VLSI circuitdesign technology, Complex systems design and processors, Design process in embedded system	Design an VLSI circuit in embedded software
Week 3	formalization of system design, design	Create a simple program using

	process and design examples, classification of embedded systems, skills required for an embedded system designer	embedded software
Week 4	Introduction-8051 Architecture- Memory Organization- Internal RAM Structure- Stack Operation	Create an simple ALP using PIC controller based on registers and memories
Week 5	Addressing Modes- Instruction Set- Assembler Directives	Implement the interface programs based on parallel ports and interrupts.
Week 6	Assembly Language Programming Examples.	Create a memory based ALP using PIC.
Week 7	8051 Hardware- Introduction, Parallel ports, External Memory Interfacing- Program and Data Memory	Draw a simple IoT design in tinkercad.
Week 8	Timers and Counters, Interrupts, Serial ports; 8051 Interface- Interfacing 8255 with 8051	Implement these designs in tinkercad.
Week 9	7-Segment display, Interfacing ADC andDAC, Interfacing Stepper Motor, Traffic Light Control.	Implement these designs in tinkercad.
Week 10	Functional Requirements - Components ofIoT: Sensors – Actuators – Embedded Computation Units – Communication Interfaces	Create a simple designs based on sensors and actuators in tinkercad.
Week 11	Software Development. RFID – ZigBEE – Bluetooth – Internet Communication- IP Addresses - MAC Addresses	Create a Bluetooth and ZigBEEbased design
Week 12	TCP and UDP – IEEE 802 Family ofProtocols – Cellular-Introduction to EtherCAT.	
Week 13	Embedded system for Smart Meter	Implement the Embedded System
Week 14	smart Grid -Smart cities and smart homes	Create a RFID based design and security attacks in Bluetooth
Week 15	Agriculture and Healthcare, Energy auditing.	

212INT3301	DATA COMMUNICATION AND COMPUTER NETWORKS	L	T	P	X	C	
		2	0	2	3	4	

Prerequisite	Operating Systems Concepts (212INT2302)
Course Category	Program Core
Course Type	Integrated Course with Theory
Objective(s)	The student will be able to learn • Provide a detailed introduction to the basic principles andtechniques used in analog and digital communications. • To know about analytical techniques to evaluate the performance of communication systems • To provide students with an overview of the concepts and fundamentals of data communication and computer networks.
Course Outcome(s)	
CO1	Inspect the basics of data communication and various categories of networks and its securities
CO2	Identify the technologies for error free secure transmission of data in data link layer
CO3	Apply various routing protocols to select optimal path and relate addressing entities in Network layer
CO4	Analyze the various security protocols at different layers of OSI architecture
CO5	Analyze the various protocols in application layer
CO6	Understand and apply different network commands using packet tracer
CO7	Analyze and apply the different networking concepts for implementing network solution through working as a team and communicate effectivelywith technical community in both the written and oral forms

Mapping of COs with Pos

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

Course Topic(s)

Unit I

Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces. Pulse Communication**:** Pulse Amplitude Modulation (PAM) – Pulse Time

Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM –PCM).

Unit II

Introduction: Networks, Uses of Networks, Network Topology, Transmission Modes - Network Hardware - Transmission technology - Categories of Networks - Network Software - Protocol Hierarchy - Design issues for the layers – Services - Reference Model: TCP/IP and OSI - Internet: Architecture of Internet - Physical Layer: Need and Issues, Data Communication, Guided transmission media, Wireless Transmission, Communication Satellites, Multiplexing and Switching.

Unit III

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.

Unit IV

Network Layer - Need and Issues - Routing algorithms - Congestion Control Algorithms – QOS - Network Layer in Internet - Network Addressing - Configuration of Router - ARP and RARP.

Unit V

Application Layer - Need and Issues – DNS - Electronic Mail – FTP – HTTP – WWW - RPC - RMI.

List of Experiments:

1. Study of Socket Programming
2. Socket Programming for Client-Server Communication
3. Configuration of Switch
4. Implementation of ARP
5. Implementation of RARP
6. Configuration of Router
7. Enable Client Server Communication using TCP Protocol
8. Implementation of Client Server communication using UDP Protocol
9. Implementation of FTP client
10. Download a File from HTTP Server
11. Implementation of Port Scanning

TEXT BOOKS:

1. Andrew S Tenenbaum, David J. Wetherall, "Computer Networks", Fifth Edition Pearson Education, 2011

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", Fiftth Edition, McGraw-Hill, 2012

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

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

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

Week	Lecture (2 Hour)	Practical (2 Hours)	X-Component (3 Hours)
Week 1	Introduction: Networks, Uses of Networks, Network Topology, Transmission Modes - Network Hardware. Transmission technology - Categories of Networks	Study of different types of network cables	Impact of Networks in Day today life, Researching Converged Network Services.
Week 2	Network Software - Protocol Hierarchy - Design issues for the layers – Services. Reference Model: TCP/IP and OSI - Internet: Architecture of Internet - Physical Layer: Need and Issues, Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.	Study of various networking devices	Packet Tracer - Help and Navigation, Network Representation, Exploring internetworking devices
Week 3	Data Communication, Guided transmission media, Wireless Transmission, Communication Satellites, Multiplexing and Switching.	Study of Basic Network commands and Network Configuration Commands	FTP Servers,
Week 4	DLL: Need and Issues - Error Detection and Correction - Protocol Verification and Data Link Layer protocols. MACSub layer - Channel Allocation Problem - Multiple Access Protocols – Ethernet	Checking Layer 2 functionality using packet tracer	Web and Email, Exploring Wireshark
Week 5	Wireless Network Security - Wireless Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security	Checking Layer 3 functionality using packet tracer	DHCP
Week 6	Wireless LANs and VLAN - Data Link Layer Switching - Connectivity Devices - Configuration of Switches	Network Protocol analysis a. Capture and Analyze TCP Segment. b. Capture and Analyze UDP Datagram. c. Capture and Analyze IP Packets	DNS Servers
Week 7	Network Layer - Need and Issues - Routing algorithms. Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access	Network Protocol analysis: a. Capture and Analyze ICMP Packets. b. Capture and Analyze ARP frame	Investigating the TCP/IP and OSI Models in Action

	Control		
Week 8	Congestion Control Algorithms – QOS - Network Layer in Internet	Domain Name Service	Configuring a Linksys router
Week 9	Network Addressing - Configuration of Router - ARP and RARP.	HTTP download Perform an experiment for port scanning with Nmap, Superscan or any other Software	Configure layer 3 switches
Week 10	Transport Layer - Need and Issues - Transport service -	Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts: a. Caesar Cipher b. Playfair Cipher c. Hill Cipher d. Vigenere Cipher	Identify MAC & IP Addresses, configure a small LAN
Week 11	Elements of Transport Protocols - Simple Transport Protocol - TCP and UDP		Managing the Medium, Examine the ARP Table, Configuring Secure Passwords and SSH
Week 12	Transport-Level Security - Secure Sockets Layer, Transport Layer Security, Secure Shell (SSH).	Implement the following algorithms a. DES b. RSA Algorithm c. Diffiee-Hellman d. MD5 e. SHA-1	Connecting a Wired and Wireless,
Week 13	Application Layer - Need and Issues – DNS		Scenario 1
Week 14	Electronic Mail – FTP – HTTP – WWW - RPC - RMI	Checking Layer 2 functionality using packet tracer. c) Configure Spanning Tree Protocol, d) Configure ARP and MAC Table.	Scenario 2
Week 15	HTTPS, DHCP Security, Web Security.	Checking Layer 2 functionality using packet tracer. a) Topologies - Ring Topology, Mesh Topology	Scenario 3

212INT2308	Artificial Intelligence	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Data Structures and Algorithms (212INT2303)						
Course Category	Program Core						
Course Type	Integrated Course with Theory						
Objective(s)	• To understand the basic concepts in AI • To understand various search techniques in problem solving • To understand propositional logic, first logic and their applications • To understand various learning techniques						
Course Outcome(s)							
CO1	Explain the foundation and history of Artificial Intelligence as well as science of Agent design.						
CO2	Illustrate the use of problem solving techniques such as the various search methods , games and constraint satisfaction problems.						
CO3	Demonstrate AI's use of knowledge representation through logic agent and first order logic to address the AI problem.						
CO4	DesignsimplesoftwaretoexperimentwithvariousAI conceptsandanalyzeresults.						
CO5	Buildself-learningandresearchskillstobeabletotackleatopicofinterestonhis/herownoraspart ofateam						

Mapping of COs with Pos

COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3												2	
CO2		3	2		3								3		
CO3		3	2		2		3					1	3	3	2
CO4		2			2						3	1	2	3	
CO5									3		3		3	3	
	1	**3**	**2**	**0**	**2**	**0**	**3**	**0**	**3**	**0**	**3**	**1**	**3**	**3**	**2**

Course Topic(s)

UNIT I

Intelligent Agents – Agents and environments, Goodbehaviour, The nature of environments- The structure of agents. ProblemSolving- problemsolving agents, example problems, search for solutions, uniformed search strategies.

UNIT II

Informedsearchandexploration–Informedsearchstrategies, heuristicfunction–, localsearch algorithmsandoptimisticproblems. Constraintsatisfactionproblems(CSP)- Backtrackingsearchand LocalsearchforCSP, The Structure ofproblems- AdversarialSearch- Games,Optimaldecisions in games , Alpha – Beta Pruning

UNIT III

Logical Agents- Knowledge based agents, Propositional logic, Reasoning patterns in Propositional logic- Firstorderlogic–Syntaxandsemanticsforfirstorderlogic- Using firstorderlogic, Knowledgeengineeringinfirstorderlogic

UNIT IV

InferenceinFirstorderlogic– prepositionalversusfirstorder logic, unificationandlifting-forwardchaining–backward chaining – Resolution.- Ontological Engineering, Categories and Objects, Actions, Situations and Events.

UNIT V

Learningfromobservations-Formsoflearning,Inductivelearning,Learningdecisiontrees, Ensemble learning,Knowledgeinlearning- Logicalformulationoflearning, Explanation basedlearning,Learningusingrelevantinformation, Inductivelogicprogramming- Statistical learningmethods-Learningwithcompletedata-Learningwithhiddenvariable

TEXTBOOK

1. StuartRussell,PeterNorvig,"ArtificialIntelligence–AModernApproach",2ndEdition, Pearson Education / Prentice Hall of India, 2004.

REFERENCES

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2. ElaineRichandKevinKnight,"ArtificialIntelligence",2nd Edition,TataMcGraw-Hill, 2003.
3. GeorgeF.Luger,"ArtificialIntelligence-StructuresandStrategiesforComplexProblem Solving",Pearson Education / PHI, 2002

List of Experiments:

S.No	Name of the Experiment
1	Study of Prolog.
2	Write simple fact for the statements using PROLOG.
3	Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
4	WAP to implement Factorial, Fibonacci of a given number.
5	Write a program to solve 4-Queen problem.
6	Write a program to solve 8 queens problem
7	Write a program to solve traveling salesman problem.
8	Write a program to solve water jug problem using LISP
9	Solve any problem using depth first search.
10	Solve any problem using best first search.
11	Solve 8-puzzle problem using best first search
12	Solve Robot (traversal) problem using means End Analysis

Week	Lecture (2 Hour)	X-Component (3 Hours)
Week 1	Intelligent Agents – Agents and environments, Goodbehaviour, The nature of environments	Basics of Turbo Prolog
Week 2	The structure of agents. Problem Solving	Program to categorize animal characteristics.
Week 3	problem solving agents, example problems, search for solutions, uniformed search strategies.	Implement the uninformed search strategies.
Week 4	Informed search and exploration – Informed search strategies, heuristic function –, local search algorithms and optimistic problems. Constraint satisfaction problems (CSP)	Solve the CSP problems.
Week 5	Backtracking search and Local search for CSP, The	Write a program to solve

	Structure of problems	traveling salesman problem.
Week 6	Adversarial Search - Games , Optimal decisions in games , Alpha – Beta Pruning	Implement the Alpha and Beta pruning.
Week 7	Logical Agents- Knowledge based agents, Propositional logic, Reasoning patterns in Propositional logic	Implement the Proportional logic problems
Week 8	First order logic –Syntax and semantics for first order logic	Implement the first order logic syntax, semantics and their knowledge engineering
Week 9	Using first order logic, Knowledge engineering in first order logic	
Week 10	Inference in First order logic – prepositional versus first order logic, unification and lifting	Program to demonstrate family relationship.
Week 11	forward chaining – backward chaining – Resolution.	Implement the forward and backward chaining
Week 12	Ontological Engineering, Categories and Objects, Actions, Situations and Events.	Implement the objects and actions in family relationships.
Week 13	Learning from observations - Forms of learning , Inductive learning ,Learning decision trees , Ensemble learning , Knowledge in learning	Implement the Ensemble learning
Week 14	Logical formulation of learning, Explanation based learning ,Learning using relevant information, Inductive logic programming	Solve Robot (traversal) problem using means End Analysis
Week 15	Statistical learning methods - Learning with complete data - Learning with hidden variable	

212INT2306	INFORMATION STORAGE MODELING AND RETRIEVAL	L	T	P	X
		2	0	2	3
Prerequisite	Nil				
Course Category	Professional Elective				
Course Type	Integrated Course with Theory				
Objective(s)	• Understand Storage Area Networks characteristics and components. • Describe the challenges associated with data center networking and the need for switch network convergence. • Storage Area Networks including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center. • Describe the business continuity and disaster recovery in a storage infrastructure. • Describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities. • Identify key areas to monitor in a data center for different components in a storage				
Course Outcome(s)					
CO1	Identify and describe the functions to build data center networking for switch network				
CO2	Discuss different types of logical and physical components of a storage infrastructure				
CO3	Understand the importance of fiber Channel protocols and how to communicate with each other and the benefits of the different network storage options for different application environments				
CO4	Identify single points of failure in a storage infrastructure and list solutions				
CO5	Identify and analyzes the common threats in each domain				

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		3										3		
CO2	1	3				3					3		3	3	
CO3	1			3			3			3			3		
CO4	1	3	3	3					3				3		2
CO5	1	3	3								3			3	
	2	**3**	**3**	**2**	**0**	**3**	**3**	**0**	**3**	**3**	**3**	**0**	**3**	**3**	**2**

Week	Lecture (2 Hour)	Practical (2 Hours)	X-Component (3 Hours)
Week 1	File Systems – Database Systems – Levels of Abstraction - Schema and Instances – Data	Study of different database models	1. Case Study: Oracle DB, MySQL/MongoDB, MS Access,

	Models – Relational Model: Structure of relational model		MS Sql ServerPostgreSQL 2. Analyse a DB Design project, find its requirements
Week 2	Schema-instance distinction - keys – relational query language - relational algebra	Create a relational structure for a data base system	
Week 3	SQL - Data definition language (DDL) - Data manipulation language (DML)	Implement DDL commands along with constraints(keys) to create/alter/drop tables Use DML commands to operate on the databases (insert/update/delete)	Use the DB Projectrequirements to create DB, respective tables and keys.
Week 4	Data retrieval (clauses – joins – set operators – aggregate functions - sub queries)	Use data retrieval commands with SQL a. SELECT clause b. WHERE clause c. GROUPBY d. ORDERBY e. WITH clause f. Aggregate functions	Use Data retrieval commands and DCL commands to retrieve data from the database Project
Week 5	Transaction control -Data control language (DCL) – integrity constraints - views – sequences – indexes – synonyms	Use DCL to grand and revoking permissions on tables and database	
Week 6	functions and procedures – triggers	Implement Stored procedures and functions	
Week 7	Entity-Relationship Model – Attributes – keys – design issues - Functional Dependencies – Non-Loss Decomposition Functional Dependencies	Create ER diagrams, analyse functional dependencies and decompositions	Create ER diagram for the Project
Week 8	First Normal Form – Second Normal Form – Third Normal Form	Normalization case studies	Apply normalization on the DB Project
Week 9	Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form	Normalization case studies	
Week 10	Physical Storage Media – RAID - File Organization	Study the recent RAID models provided by OS	Use the DB project to apply indexing, hashing technique

	– Organization of Records in Files	and DB	and analyse the query execution speed with the DB
Week 11	Indexing and Hashing – Ordered Indices – B+ tree Index Files Static Hashing – Dynamic Hashing	Use index and hash with tables	
Week 12	Query Processing Overview – Catalog Information for Cost Estimation – Query Optimization.	Use catalogue with tables	
Week 13	Transaction Concepts – Transaction Recovery – ACID Properties	Transaction management Study	Analyse the DB for transaction management, use TCL tomanage the DML commands
Week 14	Need for Concurrency Control - Schedule and Recoverability- Serializability and Schedules	Study of TCL commands	
Week 15	Concurrency Control – Types of Locks- Deadlock Handling-Time Stamp based Concurrency Control – Recovery Techniques - Immediate Update -Deferred Update - Shadow Paging.	Handle DML through transaction control queries	

212INT2307	SOFTWARE CONSTRUCTION AND MANAGEMENT	L	T	P	X
		3	0	2	0
Prerequisite	Nil				
Course Category	Program Core				
Course Type	Theory with Practical				
Objective(s)	• This course helps to understand theories, methods, and technologies applied for professional software development. • To learn how the requirements for the software project is extracted from customers. • To learn how design and testing are carried out for a project and also how the software is budgeted.				

CO1	Analyze and identify an appropriate process model to develop a given project
CO2	Understand the importance of requirements engineering process
CO3	Understand the design concepts and different real time systems and translate requirements in to design document
CO4	Knowledgeable to choose and conduct required testing activity for the given project
CO5	Understand how the project budget is estimated based on measures and metrics.

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1		3					3					1		
CO2		2	3			2	3				3			3	
CO3		3	1			3									2
CO4					3					3				2	
CO5							3				3		1		
	1	**3**	**2**	0	**3**	**3**	**3**	**3**	0	3	3	**0**	**1**	**3**	**2**

Week	Lecture (3 Hour)	Practical (1 Hours)
Week 1	What is Software? How it is getting developed (Phases).Discussion on different software development life cycle models. Course Highlights.	How to use Rational Rose software?. Introduction to UML diagrams.
Week 2	Comparison of various life cycle models. How to justify the selection of particular SDLC model for a given project.	Problem discussion and Preparation of SRS Document.
Week 3	Discussion on most popular SDLC model used currently in the industry	Preparation of Project Plan based on SRS.

Week 4	How to gather/extract requirements from customers	Develop an Use case diagram for a project
Week 5	The steps involved in requirements gathering engineering process.	Develop an Entity Relationship diagram for a project
Week 6	How to validate and manage the requirements	Develop a Data flow diagram for a project
Week 7	What is the condition for best design?	Develop a Sequence diagram for a project
Week 8	How to choose the architectural styles for a given project.	Developing a software
Week 9	Discussion on some real time system design.	Writing test cases based on SRS
Week 10	Devising a strategy to test the developed software.	Test bed setup. Perform Smoke and Sanity Test
Week 11	How a developer can test the software	Executing the test cases
Week 12	How to perform System testing? and How to manage the different software versions?.	Preparing a Bug report
Week 13	How software cost is estimated?	Debugging
Week 14	How to make Risk Management Plan and Mitigation Plan.	Performing regression test and retest
Week 15	How to speed up the software development process?.	Demo of a Project

TEXT BOOKS

1.1. Roger S. Pressman, “Software Engineering: A Practitioner's Approach”, seventh Edition, Mc-Graw Hill, 2014.

REFERENCE BOOKS

1. Steve McConnell, “Code Complete”, Second Edition, Microsoft Press.2004
2. Ian Somerville, “Software Engineering”, Addison-Wesley, Ninth edition, 2011.
3. Richard E. Fairley, “Software Engineering Concepts”, Second Edition McGraw- Hill, 1985.

212INT2102	Cyber Security and Forensics	L	T	P	X
		3	0	0	0
Prerequisite	**Nil**				
Course Category	**Program Core**				
Course Type	**Theory**				
Objective(s)	• Understand Keyterms 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.				
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 COs with Pos

COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2					2				**1**		2		
CO2	3	3	1			2		2				2	2		
CO3	3	3	3	**1**	2				2	2	**1**			1	
CO4	3	3	3			1	**1**				2	**1**			2
CO5	3	1	2		2	2		**1**	**1**			2	2	1	
	3	**2**	**2**	1	**2**	**2**	**2**	**2**	2	2	1	**2**	**2**	**1**	**2**

Course Topic(s)

UNIT I

History of Internet- Cyber Crime- Information Security- Guidelines to choose web browsers- Securing web browser- Antivirus- Email security- Guidelines for setting up a Secure password- Two-steps authentication- Password Manager- Wi-Fi Security.

UNIT II

Guidelines for social media security- Tips and best practices for safer Social Networking- Basic Security for Windows- User Account Password- Trojans and backdoors-Sniffers and Keyloggers-Honeypot

UNIT III

Introduction to mobile phones- Smartphone Security- Android Security- IOS Security- Online Banking Security- Mobile Banking Security- Security of Debit and Credit Card- UPISecurity - Security of Micro ATMs- e-wallet Security Guidelines- Security Guidelines for Point of Sales(POS)

UNIT IV

Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging- Data Recovery, Encase and FTK tools, retrieving information- process of computer forensics and

digital investigations, processing of digital evidence, digital images.

UNIT V

Mobile Forensics-Imaging/Cloning-Analysis & Examination, Reporting- SIM card Forensics, Imaging and Analysis and Reporting – Faraday Bag-and data recovery- retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

TEXT BOOKS

1. 1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", seventh Edition, Mc- Graw Hill, 2014.

REFERENCE BOOKS

1. Steve McConnell, "Code Complete", Second Edition, Microsoft Press.2004
2. Ian Somerville, "Software Engineering", Addison-Wesley, Ninth edition, 2011.
3. Richard E. Fairley, "Software Engineering Concepts", Second Edition McGraw- Hill, 1985.

Week	Lecture (3 Hour)	X-Component (3)
Week 1	History of Internet- Cyber Crime- Information Security	How to secure our personal Information? List suitable applications for the same and have a practice on it.
Week 2	Guidelines to choose web browsers- Securing web browser- Antivirus- Email security	How to choose the suitable web browser for our personal use?
Week 3	Guidelines for setting up a Secure password- Two-steps authentication- Password Manager- Wi-Fi Security.	Show different password cracking mechanisms And explain how to create a secure password?
Week 4	Guidelines for social media security- Tipsand best practices for safer Social Networking	How our Identity is stolen in the social media? How to prevent it?
Week 5	Basic Security for Windows- User Account Password	How to crack windows password?
Week 6	Trojans and backdoors-Sniffers and Keyloggers-Honeypot	How to steal others confidential information? How to prevent it?
Week 7	Introduction to mobile phones- Smartphone Security- Android Security	What are secure mobile settings? Do you know what type of informationcan be extracted from mobile phone?
Week 8	IOS Security- Online Banking Security- Mobile Banking Security- Security of Debit and Credit Card	How debit card frauds are happening?How to prevent it?
Week 9	UPI Security - Security of Micro ATMs- e-wallet Security Guidelines- Security Guidelines for Point of Sales(POS)	What is the problem in POS? How people are losing their money? How to prevent it?
Week 10	Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging	Download FTK Imager and Install it in a system. Use pen drive as evidence.
Week 11	Data Recovery, Encase and FTK tools, retrieving information	Use encase tool and extract information from any evidence
Week 12	process of computer forensics and digital investigations, processing of digital evidence,	How investigations can be done on particular evidence?

	digital images.	
Week 13	Mobile Forensics-Imaging/Cloning-Analysis & Examination, Reporting	Take mobile phone as evidence and clone it using forensics tools?
Week 14	SIM card Forensics, Imaging and Analysisand Reporting – Faraday Bag-and data recovery	How to study the SIM card details?
Week 15	retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	What is hashing? How it will be useful in the forensic study?

INT21RXXX	DATA SCIENCE AND DATA VISUALIZATION	L	T	P	X	C	H
		2	0	2	3	4	7
Prerequisite	Information Storage, Modelling and Retrieval (212INT2306)						
Course Category	Program Core						
Course Type	Integrated Course with Theory						
Objective(s)	The student will be able to learn • Students will develop relevant programming abilities. • Students will develop the ability to build and assess data-based models. • Students will demonstrate skill in data management. • Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively						
Course Outcome(s)							
CO1	Demonstrate proficiency with statistical **analysis of data**.						
CO2	Develop the ability to build and assess data-based **models.**						
CO3	Execute statistical analyses with professional statistical **software.**						
CO4	Demonstrate skill in **data management**.						
CO5	Apply data science concepts and methods to **solve** problems in real-world contexts and will **communicate** these solutions effectively						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3				3								3		
CO2		3	3				3							3	
CO3			2	2	3							1	2		
CO4			2	2				3						2	
CO5										3		1			1
	3	3	2	2	3	0	3	3	0	3	0	1	3	3	1

Week	Lecture (2 Hour)	Practical (2 Hours)	X-Component (3 Hours)
Week 1	Introduction to Data collection and Management, Data science process, Sources of data	Introduction to R tool for data science	Introduction to R tool fordata science
Week 2	Data collection and APIs, Exploring and fixing data	Perform Data exploration and preprocessing in Python	Basics of R programming
Week 3	Data storage and management, using multiple data sources	Perform data analysis from multiple data sources	

Week 4	Univariate Statistics : Understanding the uses of measures of locations, dispersion and shapes for univariate data sets using numerical values	Perform Univariant statistics using R	MapReduce application for word counting on Hadoop cluster
Week 5	Multivariate Statistics: Covariance – Correlations: Pearson, Kendall and Spearman Correlations –	Perform multivariant statistics using R	K-means clustering using map reduce in Hadoop
	Covariance matrix-Partial and Multiple correlations in general case		
Week 6	using numpy and scipy packages, using pandas and linalg packages	Data analysis using python	Graph Analytics Use Cases
Week 7	Simple and multiple bar charts – Histograms – Boxplots – Density plots – Violin pots - Beesworm plots, Scatter plots	Data visualization usingR	
Week 8	Creating heatmaps - drawing conclusions and understanding the nature of data	Working with heatmaps	Real time AnalyticsPlatform
Week 9	Python packages like matplotlib, seaborn etc for data visualization	Working with python packages	
Week 10	Inferential Statistics : Testing of statistical hypothesis – Learning the formulation of null and alternative hypothesis for various situations	Implementation of Inferential statistics	Unstructured data into NoSQL data and do all operations such as NoSQL query with API
Week 11	Understanding the significance of p-values – Confidence intervals Testsof significance related to mean		
Week 12	including one way ANOVA and the significance of correlation -Confidence Intervals	Working on ANOVA tool	Big data for blogs
Week 13	Visualization of volumetric data, vector fields, processes and simulations	Data visualization and simulations	
Week 14	Visualization of maps, geographic information, GIS systems	Study of GIS systems for data analysis	Recommendation Systems using Hadoop libraries
Week 15	collaborative visualizations, evaluating visualizations	Study of collaborative visualization	

PROFESSIONAL ELECTIVES

COMPUTER PROGRAMMING

213INT2306	SYSTEM SOFTWARE	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Computer Organization and Assembly Language Programming(212INT1101)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To introduce the essential concepts of System Programming • To know about the functions of loaders, linkers and macroprocessors.						

Course Outcome(s)	
CO1	Know the background Knowledge of System Software
CO2	Design a simple Assembler
CO3	Identify the use of Linkers and Loaders
CO4	Understand Machine Independent Macro Processor
CO5	Formulate various Compilers and Interpreters

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3					2						2		
CO2		1					3			2		3		1	
CO3		3					2			3					2
CO4		3					2							3	
CO5		1					1			3			2		

Course Topic(s)

UNIT 1 : BACKGROUND

Introduction – System Software and Machine Architecture – The Simplified Instructional Computer (SIC) – Machine architecture - Data and instruction formats - addressing modes - instruction sets - I/O and programming. Practical: Basic system programming

UNIT 2 : ASSEMBLERS

Basic Assembler Functions – Machine Dependent Assembler Features – Machine Independent Assembler Features – Program relocation - Machine independent assembler

features - Literals –
Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - Implementation example - MASM assembler. Practical: Assembly languageprogramming

UNIT 3: LOADERS AND LINKERS

Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader -Machine dependent loader features - Relocation – Program Linking – Algorithm andData Structures for Linking Loader - Machine-independent loader features - AutomaticLibrary Search – Loader Options - Loader design options - Linkage Editors – DynamicLinking – Bootstrap Loaders - Implementation example - MSDOS linker. Practical: Dynamic link programming

UNIT 4: MACRO PROCESSORS

Basic macro processor functions - Macro Definition and Expansion – Macro Processor Algorithm and data structures - Machine-independent macro processor features - Concatenation of Macro Parameters – Generation of Unique Labels – Conditional Macro Expansion – Keyword Macro Parameters-Macro within Macro-Implementation example - MASM Macro Processor – ANSI C Macro language. Practical: Macro implementation

UNIT 5: SYSTEM SOFTWARE TOOLS

Text editors - Overview of the Editing Process - User Interface – Editor Structure. - Interactive debugging systems - Debugging functions and capabilities – Relationship withother parts of the system – User-Interface Criteria. Practical: User interface design

TEXT BOOK

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2006.

REFERENCES

1. J. Nithyashri, "System Software", Tata McGraw Hill, 2nd Edition, 2010.
2. A.A. Puntambekar, I. A. Dhotre, "System Programming", McGraw Hill, 2008.

213INT1102	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Theory						
Objective(s)	• To know about OOAD method • To know about software design steps						
Course Outcome(s)							
CO1	Pointing out the importance and function of each UML model throughout the process of object-oriented analysis and design and explaining the notation of various elements in these models						
CO2	Highlighting the importance of object-oriented analysis and design patterns						
CO3	Providing students with the necessary knowledge and skills in using object-oriented CASE tools						
CO4	Applying Design Patterns in software development process						
CO5	Familiar with various coding and testing process						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	3							2		1	2		
CO2		3	2		3									1	
CO3		3	3		2										2
CO4					3	3						1		3	
CO5		2	2				3			1			2		

Course Topic(s)

UNIT 1 : UML DIAGRAMS

Introduction to OOAD – Unified Process - UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams

UNIT 2 : DESIGN PATTERNS

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller - Design Patterns – creational - factory method - structural – Bridge – Adapter -behavioral – Strategy – observer

UNIT 3 : CASE STUDY

Case study – the Next Gen POS system, Inception -Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition

UNIT 4 : APPLYING DESIGN PATTERNS

System sequence diagrams - Relationship between sequence diagrams and Logical

architecture and UML package diagram – Logical architecture refinement - UML class diagrams - UML interaction diagrams - Applying GoF design patterns

UNIT 5 : CODING AND TESTING

Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing

TEXT BOOK

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", fourth Edition, Pearson Education, 2013.

REFERENCES

1. Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010.
2. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, 1995.
3. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.

213INT2310	DESIGN AND ANALYSIS OF ALGORITHM	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Structures and Algorithms (212INT2303)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• Analyze the asymptotic performance of algorithms. • 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 Outcome(s)							
CO1	Apply the basic concepts of algorithms and analyze the performance of algorithms						
CO2	Identify various algorithm design techniques for developing algorithms						
CO3	Analysis various searching, sorting and graph traversal algorithms						
CO4	Understand NP completeness and identify different NP complete problems						
CO5	Formulate the advanced topics on algorithms						

Mapping of COs with Pos

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

UNIT 1 : BASIC CONCEPTS OF ALGORITHMS

Introduction – Notion of Algorithm – Fundamentals of Algorithmic Solving – Important Problem types – Fundamentals of the Analysis of Algorithm Efficiency - Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.

UNIT 2 : MATHEMATICAL ASPECTS AND ANALYSIS OF ALGORITHMS

Mathematical Analysis of Non-recursive Algorithm – Mathematical Analysis of Recursive Algorithm – Example: Fibonacci Numbers – Empirical Analysis of Algorithms – Algorithm Visualization. Practical: Mathematical Analysis of Recursive Algorithm

UNIT 3: ANALYSIS OF SORTING AND SEARCHING ALGORITHMS

Brute Force – Selection Sort and Bubble Sort – Sequential Search and Brute-force string matching – Divide and conquer – Merge sort – Quick Sort – Binary Search – Binary tree- Traversal and Related Properties – Decrease and Conquer – Insertion Sort – Depth first Search and Breadth First Search. Practical: Sorting

UNIT 4: ALGORITHMIC TECHNIQUES

Transform and conquer – Presorting – Balanced Search trees – AVL Trees – Heaps and Heap sort – Dynamic Programming – Warshall's and Floyd's Algorithm – Optimal Binary Search trees – Knapsack problem and memory functions - Greedy Techniques – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman trees. Practical: Trees

UNIT 5: ALGORITHM DESIGN METHODS

Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Subset-Sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem – NP and NP-Complete problems – Approximation Algorithms for NP – Hard Problems.

Practical: Knapsack problem

TEXT BOOK

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithm”, 3rd Edition, Pearson Education India, 2013.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms“, PHI Learning Private Limited, 2012..

REFERENCES

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, “Introduction to Algorithms”, PHI Pvt. Ltd., 2001.
2. Sara Baase and Allen Van Gelder, “Computer Algorithms - Introduction to Design and Analysis”, 2nd Impression, Pearson Education India, 2008.
3. A.V.Aho, J.E. Hopcroft and J.D.Ullman, “The Design and Analysis of Computer Algorithms”, Pearson Education Asia, 2003.

213INT2301	DATA ANALYSIS WITH PYTHON	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	This course is designed to teach students how to analyze different types of data using Python. Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.						
Course Outcome(s)							
CO1	Explore Python language fundamentals, including basic syntax, variables, and types						
CO2	Use functions, create and manipulate regular Python lists by using data structures concepts						
CO3	Understand the basic object oriented concepts in python						
CO4	Effectively use numerical analysis libraries of python						
CO5	Create and customize plots on real data and supercharge your scripts with control flow, and get to know the Pandas Data Frame						

Mapping of COs with Pos

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

Course Topic(s)

UNIT I: PYTHON FUNDAMENTALS FOR DATA ANALYSIS

Python data structures, Control statements, Functions, Object Oriented programming concepts using classes, objects and methods, Exception handling, Implementation of user- defined Modules and Package, File handling in python.

UNIT II: INTRODUCTION TO DATA UNDERSTANDING AND PREPROCESSING

Knowledge domains of Data Analysis, Understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

UNIT III: DATA PROCESSING AND VISUALIZATION

Data Formatting, Exploratory Data Analysis, Filtering and hierarchical indexing using

Pandas. Data Visualization: Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.

UNIT IV: MATHEMATICAL AND SCIENTIFIC APPLICATIONS FOR DATA ANALYSIS

Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basicindexing and slicing, Boolean indexing, Fancy indexing, Universal functions, Data processing using arrays, File input and output with arrays. Analysing Web Data: Data wrangling, Web scrapping, Combing and merging data sets, Reshaping and pivoting, Data transformation, String Manipulation, case study for web scrapping.

UNIT V: MODEL DEVELOPMENT AND EVALUATION

Introduction to machine learning- Supervised and Unsupervised Learning, Model development using Linear Regression, Model Visualization, Prediction and Decision Making, Model Evaluation: Over-fitting, Under-fitting and Model Selection.

TEXT BOOKS

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. Reema Thareja, "Python Programming using Problem Solving approach",Oxford University press
3. Wes Mckinney "Python for Data Analysis", First edition, Publisher O'Reilly Media.

REFERENCE BOOKS

1. Allen Downey ,JeffreyElkner ,Chris Meyers,: Learning with Python, Dreamtech Press
1. David Taieb ,"Data Analysis with Python: A Modern Approach " 1st Edition, Packt Publishing

213INT1304	STATISTICS USING R PROGRAMMING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	The student will be able to learn • Use R for statistical programming, computation, graphics, and modeling, • Write functions and use R in an efficient way, • Fit some basic types of statistical models • Use R in their own research, • Be able to expand their knowledge of R on their own.						
Course Outcome(s)							
CO1	List motivation for learning a programming language						
CO2	Access online resources for R and import new function packages into the R workspace						
CO3	Import, review, manipulate and summarize data-sets in R						
CO4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests						
CO5	Perform appropriate statistical tests using R Create and edit visualizations with						

Mapping of COs with Pos

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

Course Topic(s)

UNIT-I:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II:

R Programming Structures, Control Statements, Loops, - Looping Over NonvectorSets,- If- Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

UNIT-III:

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example:

Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files, **UNIT-IV:**

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

UNIT-V:

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests,

TEXT BOOKS:

1) The Art of R Programming, A K Verma, Cengage Learning.
2) R for Everyone, Lander, Pearson
3) The Art of R Programming, Norman Matloff, No starch Press.

REFERENCE BOOKS:

1) R Cookbook, Paul Teetor, Oreilly.
2) R in Action, Rob Kabacoff, Manning

213INT2311	COMPONENT BASED TECHNOLOGY	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Object Oriented Programming using Java (212INT2304)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To deal with the fundamental properties of components, technology and architecture and middleware. • Students are given exposure to java based component technologies suchas Java Beans, EJB and RMI. • To impart knowledge on component technologies such as CORBA, ORB and application server. • To introduce COM, DCOM and .NET technologies. • To identify the component frameworks and its development						
Course Outcome(s)							
CO1	Demonstrate how components can be the key to successful software design, construction & delivery of software solutions through reuse						
CO2	Familiarity with the Java realization of components including Java Beans, EJB, and Java RMI						
CO3	Expertise with the CORBA realization of components						
CO4	Gaining extensive information about distributed object systems and mastering the .NET realization of components (.NET assemblies)						
CO5	Provide in depth knowledge in component frameworks & its development						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION

Software Components – objects – fundamental properties of Component technology – modules – interfaces – callbacks – directory services – component architecture – components and middleware. Practical: Development of simple com components in VB and use them in applications.

UNIT 2 : JAVA BASED COMPONENT TECHNOLOGIES

Threads – Java Beans – Events and connections – properties – introspection – JAR files – reflection – object serialization – Enterprise Java Beans – Distributed Object models – RMI and RMI-IIOP. Practical: Deploying EJB for simple arithmetic operator.

UNIT 3 : CORBA COMPONENT TECHNOLOGIES

Java and CORBA – Interface Definition language – Object Request Broker – system object model – portable object adapter – CORBA services – CORBA component model –

containers – application server – model driven architecture. Practical: SIMPLE APPLICATION USING CORBA

. UNIT 4: NET BASED COMPONENT TECHNOLOGIES

COM – Distributed COM – object reuse – interfaces and versioning – dispatch interfaces – connectable objects – OLE containers and servers – Active X controls – .NET components - assemblies – appdomains – contexts – reflection – remoting. Practical: Sample applications.

UNIT 5 : COMPONENT FRAMEWORKS AND DEVELOPMENT

Connectors – contexts – EJB containers – CLR contexts and channels – Component Frameworks- Object-Oriented Frameworks (OOFW) - Black Box component framework – directory objects – cross-development environment – component-oriented programming – Component design and implementation tools – testing tools - assembly tools. Practical: Distributed objects deployment-EJB and CORBA

TEXT BOOK

1. Clemens Szyperski, "Component Software: Beyond Object-Oriented Programming", Pearson Education publishers, 2003.

REFERENCES

1. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 2002.
2. Mowbray, "Inside CORBA", Pearson Education, 2003.
3. Freeze, "Visual Basic Development Guide for COM & COM+", BPB Publication, 2001.

213INT2302	PRINCIPLES OF COMPILER DESIGN	L	T	P	X	C	H
		2	1	2	0	4	5
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To understand the basics of computation • To understand the process in compilation of a programs • To understand the computer's way of generating code. • To understand the optimization techniques in code generation						
Course Outcome(s)							
CO1	Understand the basics of compilation(computing)						
CO2	Understand grammar of compilers						
CO3	Understand the intermediate form of codes in compilers						
CO4	Understand the code generation technique(Machine code)						
CO5	Understand the optimization of code in compilers						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: INTRODUCTION TO COMPILING

Compilers – Analysis of the source program – Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools - Lexical Analysis - Role of Lexical Analyzer – Input Buffering – Specification of Tokens - Recognition of tokens.

UNIT 2 : SYNTAX ANALYSIS

Role of the parser –Writing Grammars –Context-Free Grammars – Top Down parsing - Recursive Descent Parsing - Predictive Parsing – Bottom-up parsing - Shift Reduce Parsing – Operator Precedent Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser.

UNIT 3: INTERMEDIATE CODE GENERATION

Intermediate languages – Declarations – Assignment Statements – Boolean Expressions –Case Statements – Back patching – Procedure calls.

UNIT 4 : CODE GENERATION

Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Next-use Information – A simple Code generator – DAG representation of Basic Blocks – Peephole Optimization.

UNIT 5: CODE OPTIMIZATION AND RUN TIME ENVIRONMENTS

Introduction– Principal Sources of Optimization – Optimization of basic Blocks – Introduction to Global Data Flow Analysis – RuntimeEnvironments – Source Language

issues – Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing.

TEXT BOOK

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson Education Asia, 2011.

REFERENCES

1. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
2. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
3. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill, 2003.

213INT3301	GAME PROGRAMMING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To know the mechanics and logic of Game design • To train the students to acquire knowledge in game modelingtechniques • To acquire knowledge about the issues in game design • To gain skill in game engine development						
Course Outcome(s)							
CO1	Have knowledge on the concepts and techniques used in Game design						
CO2	Design and model interactive game.						
CO3	Design and implement algorithms and techniques applied to Game design						
CO4	Analyze the various Gaming platforms and Networks						
CO5	Develop some gaming applications						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					1								2		
CO2				3				3						1	
CO3	3														2
CO4					3									3	
CO5				3			2	3		3	2		2		

Course Topic(s)

UNIT 1: 3D GRAPHICS FOR GAME PROGRAMMING

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

UNIT 2 : GAME DESIGN PRINCIPLES

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding

UNIT 3 : GAMING ENGINE DESIGN

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics

UNIT 4: GAMING PLATFORMS AND FRAMEWORKS

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the

Android, iOS, Game engines - Adventure Game Studio, DX Studio, Unity

UNIT 5: GAME DEVELOPMENT

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

TEXT BOOK

1. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics"Morgan Kaufmann, 2 Edition, 2006.
2. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC,1st edition, 2011.

REFERENCES

1. Mike Mc Shaffrfy, "Game Coding Complete", Third Edition, Charles River Media, 2009.
2. Jonathan S. Harbour, "Beginning Game Programming", Course Technology PTR, 3 edition, 2009.
3. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall 1st edition, 2006.

213INT2303	PROGRAMMING WITH OPEN SOURCE SOFTWARE	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn about the various Linux distributions. • To learn the programming practices in FOSS • To explore Linux embedded device • To acquire the knowledge of open source programming usingembedded Linux device.						
Course Outcome(s)							
CO1	Work in the linux environment and contribute to free and open source software						
CO2	Implement content management systems						
CO3	Install and configure linux operating system distribution in embedded devices that support linux						
CO4	Build simple hardware projects using embedded linux devices						
CO5	Create web programming using embedded linux device						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: INTRODUCTION TO LINUX BASED DISTRIBUTIONS

Philosophy - licenses - Distributions - Desktop environments - Bash commands - Files and file systems - Partitions- Practical: Installing software – Configuration, Bash commands **UNIT 2 : PROGRAMMING TECHNIQUES AND PRACTICES**

Programming using python - GUI development - Menu and toolbar - Layout management - event-dialog - widget - Programming practices - Documentation - use of version control system in FOSS. Practical: GUI development

UNIT 3: OVERVIEW OF AN EMBEDDED LINUX DEVICE

Peripherals - Choice of distribution and installation - commands - files and file systems - configuration - game programming. Practical: File systems

UNIT 4: WEB PROGRAMMING USING EMBEDDED LINUX DEVICE

Web server - Linux - Apache - Mysql - Php - Content management systems - adding content - text - images - components, modules and plugin- development of a sample content management site. Practical: Mysql

UNIT 5: INTERFACE WITH OTHER HARDWARE

Basic Inputs and outputs - Scheduling commands with Cron - installing and testing GPIO with python- Expansion boards - Prototyping boards. Practical: Scheduling commands

TEXT BOOK

1. Roderick W Smith, “Linux Essentials”, Wiley Publications, 2012.

REFERENCES

1. Simon Monk, "Programming the Raspberrypi: Getting started with python", McGraw Hill, 2013
2. Stephen Burge,Joomla! 3 Explained: Your step-by-step guide, Pearson education, 2014.

213INT3302	MULTIMEDIA AND COMPUTER GRAPHICS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Structures and Algorithms (21INT2303)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To understand computational development of graphics with mathematics • To provide in-depth knowledge of display systems, image synthesis,shape modeling of 3D application. • To Understand basic concepts related to Multimedia including data standards, algorithms and software • To Experience development of multimedia software by utilizing existing libraries and descriptions of algorithms						

Course Outcome(s)	
CO1	Understand the proficiency in 3D computer graphics API programming
CO2	Analyze the perspective of modern computer system with modeling, analysis and interpretation of 2D and 3D visual information
CO3	Understand different realizations of multimedia tools
CO4	Develop interactive animations using multimedia tools
CO5	Understand the knowledge of different media streams in multimedia transmission

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : MULTIMEDIA SYSTEMS DESIGN

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – objects used in Multimedia systems – Multimedia Data interface standards – Multimedia Databases

UNIT 2 : MULTIMEDIA FILE HANDLING

Compression & Decompression Algorithms– Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – video image and animation – Full motion video – Storage and retrieval Technologies.

UNIT 3: HYPERMEDIA

Multimedia Authoring & User Interface – Multimedia Messaging - Hypermedia messaging – Hypermedia message component – creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems.

UNIT 4: OUTPUT PRIMITIVES

Introduction - Line - Curve and Ellipse Algorithms – Attributes –Two-Dimensional

Geometric Transformations – Two-Dimensional Viewing.

UNIT V : THREE-DIMENSIONAL CONCEPTS

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models – Animation

TEXT BOOKS

1. Prabat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2013.
2. Donald Hearn and M.Pauline Baker, "Computer Graphics C Version", Pearson Education, 2009.

REFERENCES

1. Judith Jeffcoate, Multimedia in practice technology and Applications, PHI, 2007.
2. Foley, Vandam, Feiner, Huges, 'Computer Graphics:Principles & Practice', Pearson Education, second edition 2003.

PRACTICAL EXPERIMENTS

1. To implement Bresenham's algorithms for line, circle and ellipse drawing
2. To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing.
3. To implement Cohen-Sutherland 2D clipping and window-view port mapping
4. To perform 3D Transformations such as translation, rotation and scaling.
5. To visualize projections of 3D images.
6. To convert between color models.
7. To implement RLE compression algorithm
8. To implement image compression algorithm
9. To perform animation using any Animation software.
10. To perform basic operations on image using any image editing software

213INT2312	C# AND .NET PROGRAMMING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Object Oriented Programming using Java (212INT2304)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn the technologies of the .NET framework. • To cover all segments of programming in C# starting from the language basics, followed by the object oriented programming concepts. • To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET. • To introduce advanced topics namely data connectivity, WPF, WCF and WPF with C# and .NET 4.5. • To implement mobile applications using .Net compact framework						

Course Outcome(s)	
CO1	Understand the C# programming model
CO2	Understand Object oriented concepts of C#
CO3	Model and sole Data base applications using C#
CO4	Understand and Design web based design
CO5	Understand the .NET workflow in detail

Mapping of COs with Pos

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

Course Topic(s)

UNIT I C# LANGUAGE BASICS

.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and TypesClasses and Structs – Inheritance- Generics – Arrays and ***Tuples*** – ***Operators and Casts*** – ***Indexers-Assemblies – Shared Assemblies – CLR Hosting – Appdomains***.

UNIT II C# ADVANCED FEATURES

Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection.

UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION

Diagnostics Tasks – Threads and Synchronization – Manipulating XML – SAX and DOM – Manipulating files and the Registry – Transactions – Data access with ADO.NET: Introduction, LINQ to Entities and the ADO.NET Entity Framework, ***Querying a Database with LINQ*** – Creating the ADO.NET Entity Data Model Class Library, Creating a Windows Forms Project – Data Bindings Between Controls and the Entity Data Model – ***Dynamically Binding Query Results.***

UNIT IV WINDOW AND WEB BASED APPLICATIONS

Window Based Applications – Core ASP.NET – ASP.NET Web Forms – Server Controls,Data Binding – ***ASP.NET State Management, Tracing, Caching, Error Handling, Security, Deployment, User and Custom Controls*** – Windows Communication Foundation (WCF) – Introduction to Web Services.

UNIT V .NET COMPACT FRAMEWORK

Reflection – .Net Remoting-.Net Security – ***Localization – Peer-to-Peer Networking – Building P2P Applications*** – .Net Compact Framework – Compact Edition DataStores –***Testing and Debugging – Optimizing performance – Packaging and Deployment.***

TEXT BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# and .NET 4.5", Wiley, 2012.
2. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", Apress publication, 2012.

REFERENCES:

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.
2. Andy Wigley, Daniel Moth, Peter Foot, "Mobile Development Handbook", Microsoft Press, 2011.
3. Herbert Schildt, "C# The Complete Reference", Tata McGraw Hill, 2004.

PRACTICAL COMPONENTS

1. To write a C# program using Branching and Looping statements
2. To write a C# program using Arrays and Strings methods.
3. To write a C# program using Structures and enumerations
4. To write a C# program using inheritance concepts.
5. To write a C# program using Polymorphism.
6. To write a C# program using interfaces.
7. To write a C# program by using operator overloading
8. To write a C# program using delegates, events, errors and exceptions.
9. To write a C# program using Errors and Exceptions.
10. To build a calculator widget in windows application using C#.

213INT1307	FULL STACK SOFTWARE DEVELOPMENT	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	T o get an overview of the full stack software and web development. To understand the object oriented structure and user interface programming through Python. To gain knowledge of web development using Flask Framework. To learn the web application deployment in real time scenarios. To learn to deploy the software in Linux and Windows platforms.						
Course Outcome(s)							
CO1	Understand the object oriented approach in Python.						
CO2	Develop GUI applications with Python.						
CO3	Develop GUI applications with Python.						
CO4	Package the developed code in Linux and Windows environment.						
CO5	Deploy the developed web application using Flask in real time scenarios such as AWS.						

Mapping of COs with Pos

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

Course Topic(s)

UNIT I OBJECT ORIENTED APPROACH IN PYTHON

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – Customizing Behavior Methods – Constructors – Polymorphism – Inheritance.

UNIT II USER INTERFACE APPLICATIONS IN PYTHON AND VERSIONCONTROL SYSTEM

Wxpython installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics – Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands.

UNIT III FLASK FRAMEWORK FOR WEB DEVELOPMENT

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules –Connection with Databases – Relational Database versus NoSQL – Modeling – MappingClasses to Mongodb – Building Data Layer with Mongo Engine.

UNIT IV REAL TIME DEPLOYMENT OF WEB APPLICATION

Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Auto Evaluation of Student Assignments – Deployment Using AWS or Google Cloud or Heroku.

UNIT V DEPLOYMENT OF SOFTWARE IN LINUX AND WINDOWS PLATFORM

Deployment in Ubuntu Distribution – Creation of .Deb Executable File – Deployment in Windows – Creation of Standalone Executable – Test Cases.

TEXT BOOKS:

1. Mark Lutz, "Learning Python", Fifth Edition, O' Reilly 2013.
2. http://zetcode.com/wxpython/
3. Scott Chacon and Ben Straub, "Pro Git", Free e-book under Creative commons,Second Edition, Apress, 2016.
4. Miguel Grinberg, "Flask Web Development Developing Web Applications with Python", OReilly, 2014.

REFERENCES:

1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the-littlemongodb-book.
2. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.
3. https://aws.amazon.com/education/awseducate/
4. http://packaging.ubuntu.com/html/packaging-new-software.html
5. http://www.pyinstaller.org/
6. https://pypi.org/project/py2exe/0.9.2.0/

213INT1316	ROBOTIC PROGRAMMING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	To understand the basic concepts associated with the design and Functioning and applications of Robots To study about the drives and sensors used in Robots To learn about analyzing robot kinematics and robot programming						
Course Outcome(s)							
CO1	Upon completion of this course, the students can able to apply the basic engineering						
CO2	To learn about knowledge for the design of robotics						
CO3	Will understand robot kinematics and robot programming.						
CO4	Will understand application of Robots						
CO5	To understand the Sensors ti use in robotics						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			1	2							2		
CO2	1	3			1	2								1	
CO3	1	3			1	2						1			2
CO4	1	3	2		1							1		3	
CO5	1	3	2		1							1	2		

Course Topic(s)

UNIT I-Introduction to Robot Programming

Robot programming-Introduction-Types- Flex Pendant- Lead through programming,Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation-Interlock commands Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

UNIT II-VAL Language

Robot Languages-Classifications, Structures- VAL language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications. VAL-II programming-basic commands, applications-Simple problem using conditional statements-Simple pick and place applications-Production rate calculations using robot.

UNIT III- RAPID Language and AML

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Move master command language-Introduction, syntax, simple problems. AML Language- General description, elements and functions, Statements, constants and variables-Program control statements-Operating systems, Motion, Sensor commands-Data processing.

UNIT IV- Virtual Robot

Robot cycle time analysis-Multiple robot and machine Interference-Process chart-Simple problems-Virtual robotics, Robot studio online software- Introduction, Jogging, components, work planning, program modules, input and output signals-Singularities-Collision detection-Repeatability measurement of robot-Robot economics.

UNIT V - AML Language

General description, elements and functions, Statements, constants and variables-Program control statements-Operating systems, Motion, Sensor commands-Data processing.

Text Books:

[T1] S. R.Deb, "Robotics technology and flexible automation", Tata McGraw Hill publishing company limited, 1994.

[T2] Mikell. P. Groover, "Industrial Robotics Technology", Programming and Applications, McGraw Hill Co, 1995.

Reference Books:

[R1] Klafter. R.D, Chmielewski.T.A. and Noggin's., "Robot Engineering : An Integrated Approach", Prentice Hall of India Pvt. Ltd.,1994.

[R2] Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987.

[R3] Craig. J. J. "Introduction to Robotics mechanics and control", Addison-Wesley, 1999

Software Management

213INT1305	DATA WAREHOUSING AND MINING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To know the concepts and techniques of data mining and data warehousing • To understand the systems for data warehousing and/or data mining						
Course Outcome(s)							
CO1	Learn concepts in Data Warehouses and implementation of architectures						
CO2	Learn data preprocessing, language, architectures, concept description						
CO3	Learn to use Association Rule Mining						
CO4	Learn Classification And Clustering Techniques						
CO5	Learn Recent Trends .in Data Mining						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: INTRODUCTION TO DATA WAREHOUSING

Introduction - Data Warehouse - Multidimensional Data Model - Data Warehouse Architecture – Implementation - Further Development - Data Warehousing to Data Mining. Practical: Data Model

UNIT 2: DATA PREPROCESSING, LANGUAGE, ARCHITECTURES, CONCEPT DESCRIPTION

Why Pre processing - Cleaning, Integration – Transformation – Reduction – Discretization - Concept Hierarchy Generation, Data Mining Primitives, Query Language, Graphical User Interfaces – Architectures - Concept Description - Data Generalization - Characterizations - Class Comparisons - Descriptive Statistical Measures. Practical: Query Language

UNIT 3: ASSOCIATION RULES

Association Rule Mining - Single-Dimensional Boolean Association Rules from Transactional Databases - Multi-Level Association Rules from Transaction Databases. Practical: Association Rules

UNIT 4: CLASSIFICATION AND CLUSTERING

Classification and Prediction – Issues - Decision Tree Induction - Bayesian Classification - Association Rule Based - Other Classification Methods – Prediction - Classifier Accuracy -

Cluster Analysis - Types of data - Categorization of methods - Partitioning methods - Outlier Analysis. Practical: Categorization of methods

UNIT 5 : RECENT TRENDS

Multidimensional Analysis and Descriptive Mining of Complex Data Objects -Spatial Databases - Multimedia Databases - Time Series and Sequence Data - Text Databases – relationless databases- World Wide Web -Applications and Trends in Data Mining. Practical: Spatial Databases - Multimedia Databases

TEXT BOOK

1. J. Han, M. Kamber, "Data Mining: Concepts and Techniques", Harcourt India Morgan Kauffman, 2011.

REFERENCES

1. Margaret H.Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education 2006.
2. Sam Anahory, Dennis Murry, "Data Warehousing in the real world", Pearson Education 2009.
3. David Hand, Heikki Manila, Padhraic Symth, "Principles of Data Mining", PHI 2004.

213INT3305	ADVANCED DBMS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Information Storage, Modelling and Retrieval (212INT2306)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• Learn different types of databases. • Be exposed to query languages. • Be familiar with the indexing techniques.						
Course Outcome(s)							
CO1	To understand the underlying principles of Relational Database Management System.						
CO2	To understand and implement the advanced features of DBMS.						
CO3	To develop database models using distributed databases.						
CO4	To Understand the Query Processing						
CO5	To implement and maintain an efficient database system using emergingtrends						

Mapping of COs with Pos

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

Course Topic(s)

UNIT1: PARALLEL AND DISTRIBUTED DATABASES

Inter and Intra Query Parallelism – Architecture – Query evaluation – Optimization –Distributed Architecture – Storage – Catalog Management – Query Processing – Transactions – Recovery – Large-scale Data Analytics in the Internet Context – Map Reduce Paradigm – run-time system for supporting scalable and fault-tolerant execution – paradigms: Pig Latin and Hive and parallel databases versus Map Reduce. Practical: DDL, DML, TCL commands

UNIT 2: ACTIVE DATABASES

Syntax and Sematics (Starburst, Oracle, DB2) – Taxonomy – Applications – Integrity Management – Workflow Management – Business Rules – Design Principles – Properties – Rule Modularization – Rule Debugging – IDEA methodology – Open Problems. Practical: DB2 AULibrary.com

UNIT3:TEMPORALANDOBJECTsDATABASES

Overview – Data types – Associating Facts – Temporal Query Language – TSQL2 – Time Ontology – Language Constructs – Architecture – Temporal Support – Object Database and Change Management – Change of Schema – Implementing Database Updates in O2 –

Benchmark Database Updates – Performance Evaluation. Practical: SQL

UNIT 4 : COMPLEX QUERIES AND REASONING

Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Data log – Fix point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues. Practical: SQL

UNIT 5: SPATIAL, TEXT AND MULTIMEDIA DATABASES

Traditional Indexing Methods (Secondary Keys, Spatial Access Methods) – Text Retrieval – Multimedia Indexing – 1D Time Series – 2d Color images – Sub pattern Matching – Open Issues – Uncertainties. Practical: SQL Programs

TEXT BOOK:

1. Raghu Ramakrishnan "Database Management System", Mc Graw Hill Publications, McgrawHillPublications, 2014 reprint.

REFERENCES:

1. Carlo Zaniolo, Stefano Ceri "Advanced Database Systems", Morgan Kauffmann Publishers. 2007
2. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011

213INT3306	INFORMATION STORAGE MANAGEMENT	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Information Storage, Modelling and Retrieval (212INT2306)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• Understand Storage Area Networks characteristics and components. • Describe the challenges associated with data center networking and the need for switch network convergence. • Storage Area Networks including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center. • Describe the business continuity and disaster recovery in a storage infrastructure. • Describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities. • Identify key areas to monitor in a data center for different components in a storage						
Course Outcome(s)							
CO1	Identify and describe the functions to build data center networking for switch network						
CO2	Discuss different types of logical and physical components of a storage infrastructure						
CO3	Understand the importance of fiber Channel protocols and how tocommunicate with each other and the benefits of the different network storage options for different application environments						
CO4	Identify single points of failure in a storage infrastructure and list solutions						
CO5	Identify and analyzes the common threats in each domain						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION TO STORAGE TECHNOLOGY

Review data creation and the amount of data being created and understand the value of data to a business - challenges in data storage and data management - Solutions available or data storage - Core elements of a data center infrastructure - role of each element in supporting business activities.

UNIT 2 : STORAGE SYSTEMS ARCHITECTURE

Hardware and software components of the host environment - Key protocols and concepts

used by each component - Physical and logical components of a connectivity environment Major physical disk - access characteristics - and performance implications - Concept ofRAID and its components - Different Raid levels and their suitability for different application environments: RAID 0 RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6
- Compare and contrast integrated and modular storage systems - High-level architecture and working of an intelligent storage system.

UNIT 3 : INTRODUCTION TO NETWORKED STORAGE

Evolution of networked storage – Architecture – Components - and topologies of FC-SAN, NAS, and IP-SA Benefits of the different networked storage options -Understand the need for long-term archiving solutions and describe how CAS fulfills the need - Understand the appropriateness of the different networked storage options for different application environments.

UNIT 4: INFORMATION AVAILABILITY & MONITORING & MANAGING DATA CENTER

List reasons for planned/unplanned outages and the impact of downtime - impact of downtime - Differentiate between business continuity (BC) and disaster recovery (DR) - RTO and RPO - Identify single points of failure in a storage infrastructure and list solutionsto mitigate these failures - Architecture of backup/recovery and the different backup/recovery topologies - replication technologies and their role in ensuring information availability and business continuity - Remote replication technologies and their role in providing disaster recovery and business continuity capabilities - Identify key areas to monitor in a data center - Industry standards for data center monitoring and management - key metrics to monitor for different components in a storage infrastructure - key management tasks in a data center.

UNIT 5: SECURING STORAGE AND STORAGE VIRTUALIZATION

Information security - Critical security attributes for information systems - Storage security domains - List and analyzes the common threats in each domain - Virtualization technologies – block-level and file-level virtualization technologies and Processes

TEXT BOOK

1. EMC, EMC Education Services, Lastemc, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", John Wiley and Sons, 2nd edition, 2012.

REFERENCES

1. Robert Spalding, **"**Storage Networks: The Complete Reference". Tata McGraw Hill, Osborne, 2003
2. Marc Farley, "Building Storage Networks", 2nd Edition, Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Limited,2002.

213INT1306	BIG DATA ANALYTICS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To provide the students with a fundamental Of Big Data Analytics • To acquire skills various Data Analytics. • To introduce Data Mining Stream concepts. • To familiarize the students with Clustering and Framework concepts						

Course Outcome(s)	
CO1	Understand the Big Data Platform and Modern data analytic Tools
CO2	Learn neural networks, Fuzzy logic and data analytic concepts
CO3	Learn Data Mining rules to implement and Analysis
CO4	Understand types of clustering
CO5	Understand and implement the data analytic tools-Map reduce and Hadoop

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error. Practical: Hadoop Map Reduce job flow

UNIT 2 : DATA ANALYSIS

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods. Practical: Creating and customizing applications to analyze data

UNIT 3 : MINING DATA STREAMS

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions. Practical: Implementing a targeted Big Data strategy

UNIT 4 : FREQUENT ITEMSETS AND CLUSTERING

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data

sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non- euclidean space – Clustering for streams and Parallelism. Practical: Apply different classification techniques to classify the given data set

UNIT 5 : FRAMEWORKS AND VISUALIZATION

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications. Practical: Apply various association rule mining algorithms

TEXT BOOKS

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2nd edition, 2012.

REFERENCES

1. Bill Franks, T"aming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics", John Wiley & sons, 2012.
2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O"Reilly, 2011.
3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

213INT2314	SOFTWARE QUALITY ASSURANCE	L	T	P	X	C	H
		2	0	2	0	3	4

Prerequisite	Software Construction and Management (212INT2307)
Course Category	Professional Elective
Course Type	Integrated Course with Theory
Objective(s)	• Understand the quality management process. • Distinguish between the various activities of quality planning, quality assurance and quality control. • Understand the importance of standards in the quality management process and their impact on final product. • To present the concepts, techniques and metrics for quality assurance in software development. • To develop a good understanding of issues, techniques and tools for software testing
Course Outcome(s)	
CO1	Understand the need of software quality and learn software project life cycle components
CO2	Analyze software development methodologies and testing implementations.
CO3	Develop the capability to create good software quality infrastructure with effective management strategies.
CO4	Evaluate the performance of software project and develop models for software quality management.
CO5	Obtain the knowledge about various quality management standards.

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall"s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT 2 : SQA COMPONENTS AND PROJECT LIFE CYCLE

Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality

components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT3:SOFTWAREQUALITYINFRASTRUCTURE Procedures and work instructions - Templates - Checklists – 3S development - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

UNIT 4: SOFTWARE QUALITY MANAGEMENT & METRICS

Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.

UNIT 5: STANDARDS, CERTIFICATIONS & ASSESSMENTS

Quality manangement standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.

TEXT BOOK

1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.

REFERENCES

1. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 1997.
2. Mordechai Ben-Menachem “Software Quality: Producing Practical Consistent Software”, International Thompson Computer Press, 1997.

213INT2313	MOBILE APPLICATION DEVELOPMENT	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Object Oriented Programming using Java (212INT2304)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	To introduce the programming techniques and design pattern of mobile application development.						
Course Outcome(s)							
CO1	Study about the mobile application market and web services for various mobile devices						
CO2	Understand and develop the various Mobile Information Design and Mobile Platforms						
CO3	Design the User interface with various features of Android SDK like displaying pictures, menu etc						
CO4	Utilize the messaging, networking and location based service in Android application						
CO5	Create, Debug and build the apps for the latest Windows and IOS						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: 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 2: 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 – Mobile Web Applications with HTML 5

UNIT 3: ANDROID APPLICATION DEVELOPMENT

Getting to know the Android User Interfaces – 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 4 : ANDROID MESSAGING, NETWORKING, LOCATION BASEDSERVICES

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 5: IOS AND WINDOWS PHONE

Getting started with iOS – iOS Project – Debugging iOS Apps – Objective C Basics – Hello Word App – Building the derby app in iOS – Windows Phone 7 Project – Building Derby App in Windows Phone 7.

TEXT BOOK

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

REFERENCES

1. Wei – Meng Lee, "Beginning Android Application Development", Wiley 2011
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 iOS6 Development: Exploring the iOS SDK", Apress, 2013

213INT1103	ENTERPRISE RESOURCE PLANNING	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Theory						
Objective(s)	• To know the basics of ERP • To understand the key implementation issues of ERP • To know the business modules of ERP • To be aware of some popular products in the area of ERP • To appreciate the current and future trends in ERP						
Course Outcome(s)							
CO1	Understand basics and key implementation issues of ERP						
CO2	Identify various roles of human resources in an Enterprise						
CO3	Aware of ERP markets						
CO4	Learn functional modules in an ERP package						
CO5	Study current trends and predict future trends in ERP						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION

ERP: An Overview, Enterprise – An Overview, Benefits of ERP- ERP and Related Technologies- Business Process Reengineering (BPR)- Data Warehousing- Data Mining - OLAP - SCM

UNIT 2: ERP IMPLEMENTATION

ERP Implementation Lifecycle - Implementation Methodology - Hidden Costs - Organizing the Implementation – Vendors - Consultants and Users - Contracts with Vendors - Consultants and Employees - Project Management and Monitoring

UNIT 3: THE BUSINESS MODULES

Business modules in an ERP Package - Finance – Manufacturing (Production) - Human Resources - Plant Maintenance - Materials Management - Quality Management - Sales and Distribution

UNIT 4: THE ERP MARKET

ERP Market Place and Marketplace Dynamics - SAP AG - People soft – Baan - JD Edwards- Oracle corporation – QAD – SSA Global - Lawson software

UNIT 5: ERP – PRESENT AND FUTURE

Turbo Charge the ERP System – EIA - ERP and E-Business - ERP, Internet and WWW- ERP II - Future Directions and Trends in ERP

TEXT BOOK

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, New Delhi, 3rd edition 2014.

REFERENCES

1. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology, USA, 2001.
2. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – Concepts and Practice”, PHI, New Delhi, 2003.

213INT2308	SERVICE ORIENTED ARCHITECTURE	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Computer Organization and Assembly Language Programming(212INT1101)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn the concepts of distributed application development • To differentiate XML based web services from other standard models • To study the importance of service composition						

Course Outcome(s)	
CO1	Understand crucial concepts of SOA
CO2	Know the integration of SOA technological points with Web Services.
CO3	Implement of SOA in development cycle of Web Services.
CO4	Build SOA based applications for Web services, some of the prevailing standards and Technologies of Web Services.
CO5	Implement the applications based on Java Web Services

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : SOA FUNDAMENTALS

SOA – Services – Loose Coupling – The Enterprise service bus – Service Classification – Business process management – SOA and the organization – SOA and the organization - SOA in context – Message exchange patterns – SOA life cycle – Versioning – Web services**UNIT 2: SERVICE-ORIENTED ANALYSIS AND DESIGN**

SOA Terminology and Concepts - REST Design Constraints and Goals - RESTful Service-Orientation - Service Contracts with REST - Service-Orientation and REST Service-Oriented Analysis and Design with REST - Mainstream SOA Methodology - Analysis and Service Modeling with REST - Service-Oriented Design with REST HTML - Cookies - Simple PHP scripts

UNIT 3 : SERVICE COMPOSITION

Service Composition with REST - Fundamental Service Composition with REST - Advanced Service Composition with REST - Service Composition with REST Case Study - Design Patterns for SOA with REST - Service Versioning with REST - Uniform Contract Profiles

UNIT 4: RESTFUL SERVICES AND THE RESOURCE-ORIENTEDARCHITECTURE

Introducing the Simple Storage Service - Object-Oriented Design of S3 - URIs - Addressability - Statelessness - Representations - Links and Connectedness - The Uniform Interface - Resource Design - Turning Requirements into Read-Only Resources - Service Implementation - Web service case studies - Connect Resources to Each Other - ControllerCode - Model Code

UNIT 5 : SOA TRANSACTION AND SECURITY

SOA and performance - SOA and security – Service Management - Model driven service deployment – Establishing SOA and SOA governance

TEXT BOOK

1. Nicolai M.Josuttis, “SOA in design - The art of distributed system design”, O'REILLY publication, 2007.
2. 2. Raj Balasubramanian, Benjamin Carlyle, Thomas Erl, Cesare Pautasso, "SOA with REST - Principles, Patterns & Constraints for building Enterprise solutions with REST", Prentice Hall/PearsonPTR , 2012.
3. 3. Leonard Richardson and Sam Ruby, “RESTful Web Services”, O'REILLY publication, 2007.

REFERENCES

1. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson education,2005.

213INT1103	SOFTWARE PROJECT MANAGEMENT	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Theory						
Objective(s)	• To develop an awareness of the need for project planning and management. • To know about software effort estimation and activity planning. • To explore risk and people management. • To learn about project monitoring and control mechanisms. • To know about software quality management						

Course Ozutcome(s)	
CO1	Differentiate between various software process models.
CO2	Prepare project planning documents.
CO3	Estimate the software cost for proj
CO4	Perform effective activity planning.
CO5	Prepare effective project scheduling work product.

Mapping of COs with Pos

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

Course Topic(s)

UNIT I INTRODUCTION

Project – Software Projects versus Other Types of Project – Contract Management and Technical Project Management – Activities – Plans, Methods and Methodologies – Requirement Specification – Management Control – Overview of Project Planning – Introduction to Step Wise Project Planning – Programme Management and Project Evaluation.

UNIT II SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING

Software Effort Estimation: Problems with Over and Under Estimates – Basis of Software Estimating – Techniques – Expert Judgment – Cosmic Full Function Points – A Procedural Code Oriented Approach – COCOMO: A Parametric Model – Activity Planning: Objectives – Project Schedules – Projects and Activities – Sequencing and Scheduling Activities – Network Planning Models – Formulating A Network Model – Identifying Critical Path – Shortening the Project Duration – Identifying Critical Activities – Activity-on-arrowNetworks.

UNIT III SOFTWARE RISK AND PEOPLE MANAGEMENT

Categories of Risk – Framework for Dealing with Risk – Risk Identification – Risk Assessment – Risk Planning – Risk Management – Evaluating Risks to the Schedule – Applying the PERT Technique – Monte Carlo Simulation – Critical Chain Concepts – Resource Allocation: Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost – Cost Schedules – SchedulingSequence.

UNIT IV SOFTWARE PROJECT MONITORING AND CONTROL

Creating the Framework – Collecting the Data: Partial Completion Reporting – Risk Reporting – Visualizing Progress: Gantt chart – Slip chart – Ball Charts – The Timeline –Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting the Project Back to Target – Change Control.

UNIT V SOFTWARE QUALITY MANAGEMENT

Managing Contracts: The ISO 12207 Approach, Supply Process, Types, Stages, Contract Management Managing People and Organizing Teams: Understanding Behaviour, Organizational Behaviour, Motivation, The Oldham– Hackman Job Characteristics Model, Decision Making, Leadership, Dispersed And Virtual Teams, Software Quality – Importance, Defining Software Quality, ISO 9126, Software Quality Measures, Product Versus Process Quality Management, External Standards, Quality Plans.

.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Fourth Edition, Tata McGraw-Hill, 2011.

2. Walker Royce, “Software Project Management: A Unified Framework”, Pearson Education, 2004.

REFERENCES:

1. S. A. Kelkar, “Software Project Management: A Concise Study Paperback”, Prentice Hall of India, 2013.

2. Ramesh Gopalaswamy, “Managing Global Software Projects”, Tata McGraw Hill, 2001.

3. Humphrey Watts, “Managing the software process”, Addison Wesley, 1989.

4. Ashfaque Ahmed, “Software Project Management Process Driven Approach”, Auerbach Publications, 2011.

213INT1317	STATISTICAL FOUNDATION OF DATA SCIENCE	L	T	P	X	C	H
		3	0	2	0	4	5

Prerequisite	Nil
Course Category	Professional Electives
Course Type	Integrated Course with Theory
Objective(s)	• Prepare the students to understand and practice Big Data Analytics using Hadoop Ecosystem and prepare them for a Career in Analytics as a Hadoop Developer, Hadoop Administrator, Data Scientist.
Course Outcome(s)	
CO1	Understand the key issues on big data, characteristics, data sources and the associated applications in intelligent business and scientific computing.
CO2	Acquire fundamental enabling techniques and scalable algorithms in big data analytics.
CO3	Interpret business models and scientific computing paradigms, and apply software tools for Big data analytics.
CO4	Achieve adequate perspectives of big data analytics in marketing,financial services, health services, social networking, astrophysics exploration, and environmental sensor applications, etc.
CO5	Select visualization techniques and tools to analyze big data and create statistical models and understand how to handle large amounts of data.

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT 2: MINING DATA STREAMS

Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Realtime Analytics Platform(RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT 3: HADOOP

History of Hadoop- The Hadoop Distributed File System –Components of Hadoop -

Analyzing

The Data with Hadoop-Scaling Out-Hadoop Streaming-Design of HDFS-Java interfaces to HDFS-Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort–Task execution-Map Reduce Types and Formats

UNIT 4: HADOOP ENVIRONMENT

Setting up a Hadoop Cluster -Cluster specification -Cluster Setup and Installation -HadoopConfiguration-Security in Hadoop -Administering Hadoop –HDFS -Monitoring-Maintenance-Hadoop benchmarks-Hadoop in the cloud

UNIT 5: FRAMEWORKS

Applications on Big Data Using Pig and Hive –Data processing operators in Pig –Hive services –HiveQL –Querying Data in Hive -fundamentals of HBase and ZooKeeper -IBM InfoSphere-. Visualizations -Visual data analysis techniques, interaction techniques.

TEXT BOOKS:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

REFERENCES:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics", John Wiley & sons, 2012.
2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.

213INT1105	Digital Marketing	L	T	P	X	C	H
		3	0	0	0	3	3

Prerequisite	Nil
Course Category	Professional Electives
Course Type	Theory
Objective(s)	• To introduce the students with the foundations of Digital Marketing • To make the students understand the concept of SEO, Pay per Click, Google Analytics

Course Outcome(s)	
CO1	Understand Digital Marketing and Keywords, Hosting
CO2	Able to generate SEO and design email marketing and Mail Chimp
CO3	Able to build email signup forms, Adwords, Search and Design Campaigns
CO4	Analyse the behaviour of Traffic, preparing report and marketing
CO5	Apply the marketing techniques in Social Media Campaign

Mapping of COs with Pos

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

Course Topic(s)	
Unit I	Introduction to Digital Marketing and its Significance -Traditional Marketing Vs Digital Marketing - Digital Marketing Process -Website Planning and Development : Types of websites - Website Planning and Development : Keywords - Understanding Domain and Webhosting - Building Website/Blog using CMS WordPress - Using WordPress Plug-ins
Unit II	Introduction to Search Engine Optimization - Keyword Planner Tools - On Page SEO Techniques-Indexing and Key Word Placement - On Page SEO Techniques-Content Optimization - On Page SEO : Yoast SEO Plug-in - Off –Page SEO Techniques - Email Marketing- Introduction and Significance - Designing e-mail marketing campaigns using Mail Chimp
Unit III	Building E-mail List and Signup Forms - Email Marketing Strategy andMonitoring Email –Automization - Pay Per Click Advertising: Introduction - Pay Per Click Advertising: Google Adword - Type s of Bidding strategies - Designing and Monitoring search campaigns - Designin g and Monitoring Display campaigns

Unit IV	Designing and Monitoring Video campaigns - Designin g and Monitoring Universal App Campaigns - Google Analytics : Introduction and Significance - Google Analytics Interface and Setup - Understanding Goals and Conversions - Monitoring Traffic Behavior and preparing Reports - Social Media Marketing : Introduction and Significance - Facebook Marketing : Introduction Types of Various Ad Formats
Unit V	Setting up Facebook Advertising Account - Under standing Facebook Audience and its Types - Designing Facebook Advertising Campaigns - Working with Facebook Pixel Twitter Marketing: Basics - Designing Twitter Advertising Campaigns - Introduction to LinkedIn Marketing - Developing digital marketing strategy in Integration form

TEXT BOOKS

1. *Google Ad words for Beginners: A Do-It-Yourself Guide to PPC Advertising, By Cory Rabazinsky, 2015*

2. *Digital Marketing for Dummies : By Ryan Deiss and Russ Hennesberry, 2017*

3. *Email Persuasion:* ***Captivate and Engage Your Audience, Build Authority and Generate More Sales With Email Marketing*** *By Ian Brodie, 2013*

4. *Social Media Marketing All-In-One for DummiesBy Jan Zimmerman and Deborah Ng, 2017*

REFERENCE BOOKS

1. The Art of SEO, Eric Enge, Stephan Spencer, Jessie Stricchiola, 3rdEdition,O'Reilly Media Inc
2. Digital Marketing 2020, Catch your business with Digital Marketing, Danny Star

213INT1314	WEB SERVICES	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn the theoretical and practical concepts of web programming. • To introduce the programming languages for developing simple web applications. • To make students to understand about the architecture of web server and deployment of web site • To teach methodologies useful for the implementation of dynamic web applications • To efficiently design and implement web applications using server side programming languages						
Course Outcome(s)							
CO1	Understand the theoretical and practical concepts (internet basics) to design, implement and maintain a typical web page, to understand different protocols used over the internet, to obtain good knowledge in web programming in JavaScript						
CO2	Develop and incorporate dynamic capabilities in Web pages using DHTML and JavaScript.						
CO3	Understand the basic concepts of client-server architecture, features, web applications, web servers to deploy web site, to include multimedia contents						
CO4	Understand database basics related to develop dynamic web applications and Apply XML for designing web pages.						
CO5	Apply advanced web development programming to design and implement server-side software that interacts with a database for the purposes of querying the database, test and debug the software, deploy the software, to design and implement interactive web pages						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION

History and basic idea of Internet; Internet services: telnet, e-mail, ftp, WWW- HTML- List, Tables, Images, Forms, Frames, XML- Document type definition, XML Schemas,* Document Object model - Web page design: Designing web pages with HTML5 – Newelements added - semantic elements -attributes of form -graphic elements- multimedia elements-APIs-CSS-javascript-Jquery-AJAX

UNIT 2: DYNAMIC HTML

Introduction – Object refers, Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – On error – Mouse related – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data – Binding of an Image and table.

UNIT 3: MULTIMEDIA

Audio and video speech synthesis and recognition – Electronic Commerce – E-Business Model – E- Marketing – Online Payments and Security – Web Servers – HTTP request types – System Architecture – Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server.

UNIT 4 :ASP

ASP – Working of ASP – Objects –File System Objects – Session tracking and cookies – ADO – Access a Database from ASP –Server side Active-X Components – Web Resources – XML – Structure in Data – Name spaces– DTD – Vocabularies – DOM methods

UNIT 5 :DATABASE CONNECTIVITY

Database Connectivity - ADO.NET- SqlConnection- SqlCommand- Reading Data with the SqlDataReader - Working with Disconnected Data - Adding Parameters to Commands - Using Stored Procedures

TEXT BOOK

2. Deitel&Deitel, Goldberg, "Internet and World Wide Web 5th Edition – How toProgram", Pearson Education Asia, 2012.

REFERENCES

4. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA1.2", Prentice Hall of India, QUE, 1999.
5. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.
6. Rajkamal, "Web Technology", Tata McGraw-Hill, 2001.

213INT1315	MANAGING THE CLOUD	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To impart fundamental concepts in the area of cloud computing. • To impart knowledge in developing applications of cloud computing						
Course Outcome(s)							
CO1	Understanding the systems, protocols and mechanisms to support cloud computing						
CO2	Develop applications for cloud computing						
CO3	Understanding the hardware necessary for cloud computing						
CO4	Design and implement a novel cloud computing application						
CO5	Knowledge in various Cloud vendors and their products						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: INTRODUCTION

Overview – applications - intranet and cloud - examples: Amazon, Google, Microsoft, IBM – Benefits and Limitations of cloud computing - Google app engine – EMC - NETAPP - Microsoft Azure - Amazon(EC2, S3,SQS) - open stack -cloud computing services

UNIT 2: HARDWARE AND ARCHITECTURE

Clients-Security-Network-Services. Accessing the cloud: Platforms-web applications-web APIs-web browsers. Cloud storage: overview-providers. Standards: application-client- infrastructure-service.

UNIT 3: SOFTWARE AS SERVICE

Overview- Driving forces-company offerings-industries. Software plus services: Overview-mobile device integration-providers-Microsoft Online.

UNIT 4: DEVELOPING APPLICATIONS

Google – Microsoft – IntuitQuickBase - Cast Iron Cloud - Bungee Connect –Development (App engine, Azure, open stack etc.) - trouble shooting and application management.

UNIT 5: LOCAL CLOUDS AND THIN CLIENTS

Virtualization-server solutions-thin clients. Cloud Migration: cloud services for individuals-enterprise cloud- methods for migration-analyzing cloud services.

TEXT BOOKS

1. Anthony T.Velte, Toby Velte, "Cloud Computing a practical approach", Mcgraw Hill, 2010.
2. M.S.V.Janakiram, "Demystifying the Cloud – An introduction to Cloud Computing",

version 1.1, 2010.

REFERENCE BOOKS

1. Mark C. Chu-Carroll, “Code in the Cloud- Programming Google App Engine”, The Pragmatic Bookshelf Raleigh, North Carolina Dallas, Texas, 2011.
2. Breslin “Cloud Computing: Principles and Paradigms”, Wiley Press, New York, USA, 2008.

EMBEDDED AND SIGNAL PROCESSING

213INT3316	MOBILE COMMUNICATION AND COMPUTING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn the fundamental concepts of mobile communication and mobile computing. • To analyze about internet protocols, its issues while dealing with mobile computing. • To make students to understand about various communication systems such as GSM,GPRS etc., • To learn the basic concepts of adhoc networks and analyze the issues involved in it. • To design and implement mobile applications in different kinds of operating systems						

Course Outcome(s)	
CO1	Understand the basic concepts of mobile computing
CO2	Analyze about internet protocol and Mobile internet protocol.
CO3	Learn about the different kinds of mobile telecommunication system.
CO4	Analyze the issues involved in adhoc networks and learn the various kinds of adhoc networks.
CO5	Identify, design and implement mobile applications in various platforms.

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INTRODUCTION

Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes –Random Assignment Schemes – Reservation Based Schemes. Practical: MAC Protocols **UNIT 2: MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER**

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window –

Improvement in TCP Performance. Practical: Key Distribution mechanisms

UNIT 3 : MOBILE TELECOMMUNICATION SYSTEM

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS). Practical: GSM Technique

UNIT 4 : MOBILE AD-HOC NETWORKS

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security. Practical: Routing Protocols

UNIT 5: MOBILE PLATFORMS AND APPLICATIONS

Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M-Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues. Practical: Security Mechnisms

TEXT BOOK

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2012.

REFERENCES

1. Jochen H. Schller, “Mobile Communications”, Second Edition, Pearson Education, New Delhi, 2007.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.

213INT1301	INFORMATION CODING TECHNIQUES	L	T	P	X	C	H
		3	0	2	0	4	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To expose to students some concepts in information theory, and the performance characteristics of an ideal communications system. • To expose to students fundamentals in coding and its applications.						

Course Outcome(s)	
CO1	Explain basic information and channel capacity.
CO2	Understand different types of data and voice coding techniques
CO3	Explain and analyse source coding compression, decoding and error control methods as applied in communication system.
CO4	Analysis of various text and image compression techniques
CO5	Analysis of audio and video coding techniques

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : INFORMATION ENTROPY FUNDAMENTALS

Uncertainty- Information and Entropy – Source coding Theorem – Huffman coding – Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT 2 : DATA AND VOICE CODING

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoder, LPC).

UNIT 3: ERROR CONTROL CODING

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

UNIT 4: COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT 5: AUDIO AND VIDEO CODING

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG

Video standards.

TEXTBOOKS

1. Simon Haykin&Michael Moher, "Communication Systems", John Wiley and Sons, 5th Edition, 2009.
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002.

REFERENCES

1. Mark Nelson, "Data Compression Book", BPB Publication 2nd edition 1996.
2. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

213INT3307	BLUETOOTH TECHNOLOGY	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To Understand Bluetooth's standards, architecture and operation. • To Understand the APIs, radio interface and protocol layers used by Bluetooth. • To Configure Bluetooth-enabled devices including mobile phones, PDAs and Access Points. • To Install and configure Bluetooth hardware and software. • To Configure LAN access, remote access and FAX gateway access point solutions using Bluetooth						

Course Outcome(s)	
CO1	Demonstrate the students about how Bluetooth devices pair set up and the options concerning discoverability
CO2	Analyze the various kinds of data transfer between Bluetooth devices
CO3	Create trust and security related policies which are handled by Bluetooth.
CO4	Implement profiles like the Headset profile, LAN, OBEX, and Serial port compatible to specified applications.

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: BASIC CONCEPTS

Components-networks-Topologies-Protocols and Standards –ISO/OSI model-Origin- blue tooth SIG - Protocol stack - Security applications and profiles – management - test and qualification technology basics - RF and IR wireless communication.

UNIT 2: BLUETOOTH MODULE

Antennas patterns - gain and losses- types of antennas- on chip antennas radio interference - FH, modulation, symbol timing, power emission and control, performance parameters - RF architecture - Blur RF - Base band - Blue tooth device address system timing - Physical links - packet structuring types and construction - channel coding and time base synchronization.

UNIT 3 : LINK CONTROLLER AND MANAGEMENT

LCP- controller states - Pico net and scattered operations - Master / slave role switching LC Architectural overview – LMC - Link set up - Quality of service - LMP version - Name represent - Test mode.

UNIT 4 : BLUETOOTH HOST

LLC and adaptation protocol L2 cap signaling – connections- Blue tooth profiles- Version 1.0-Generic profiles-serial and object exchange.

UNIT 5: SECURITY

Encryption and security Key generation - security Modes and architecture - Low power operation and QOS management.

TEXT BOOK

1. Jennifer, Sturman, "Bluetooth Connect without cables", 2nd Edition, Pearson education 2005.

REFERENCES

1. Brent A.Miller and Bisdikian C, "Bluetooth reveeled", 2nd Edition, Pearson Education 2002.
2. Muller J, "Blue tooth Demystified", Nathan Tata Mc Graw Hill 2001.

213INT3308	WIRELESS SENSOR NETWORKS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	To teach the general principles of wireless sensor networks, and the state of the art in information processing in wireless sensor networks.						
Course Outcome(s)							
CO1	Demonstrate familiarity with common wireless sensor node architectures						
CO2	Illustrate knowledge of MAC and routing protocols developed for WSN						
CO3	Emphasize the importance of time synchronization and localization of WSN						
CO4	Interpret the operating system developed for WSN						
CO5	Identify the suitable topology for WSN						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		3	3	2		1					1	2		
CO2	3	3					1							1	
CO3	3		3												2
CO4	3	1												3	
CO5		1		2									2		

Course Topic(s)

UNIT 1 : INTRODUCTION AND OVERVIEW OF WIRELESS SENSOR NETWORKS

Introduction - Basic overview of the technology - Range of applications - Examples of category 1 and 2 WSN application - Sensor node technology - Sensor taxonomy - WN node operating environment – WN Trends - Wireless Transmission Technology and Systems – Applications of Wireless Sensor Network

UNIT 2: POWER MANAGEMENT AND ROUTING IN WSN

Distributed Power – Aware micro sensor networks - Dynamic voltage scaling techniques – Operating system for energy Scalable in WSN - Dynamic power management -Energy aware routing - Altruists or Friendly neighbors in the Pico radio sensor network - Aggregate queries - Bluetooth in the distributed sensor network - Mobile networking for smart dust

UNIT 3 : CLUSTERING AND SECURITY PROTOCOLS IN WSN

Topology discovery and clusters in sensor networks - Adaptive clustering with deterministic Cluster – Head selection -Sensor cluster's performance - Power – aware functions -Efficient flooding with passive Clustering -Security protocols in sensor networks - Communication security

UNIT 4: NETWORK MANAGEMENT AND OPERATING SYSTEM

Network management requirements - Traditional network management models - Network

management design issues – MANNA - other issues related to network management - Operating system design issues – TinyOS – Mate – MagnetOS – MANTIS – OSPM - EYES OS – SenOS – EMERALDS – PicsOS - WSN design issues -Performance modeling - Case study: Simple computation of the System Life Span. WSN Network architecture: typical network architectures-data relaying and aggregation strategies

UNIT 5 : TOPOLOGY CONTROL

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN.Topology Control - Distributed Topology Control- Design Guidelines -Ideal Features of a Topology Control Protocol .The Quality of Information - Logical and Physical Node Degrees ; Location-based Topology Control, Localization- Absolute and relative localization. Neighbor-based Topology Control -The Number of Neighbors for Connectivity - The KNeigh Protocol - The XTC Protocol; Dealing with Node Mobility

TEXT BOOKS

1. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks Technology - Protocols and Applications", John Wiley & Sons, Ltd, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley & Sons, Ltd, 2003.
3. Paolo Santi, "Topology Control in Wireless Ad Hoc and Sensor Networks", John Wiley & Sons, Ltd, 2005.

REFERENCES

1. Andreas Willing, "Protocols and Architecture for Wireless Sensor Networks", , John Wiley & Sons Ltd., 2005.
2. Ian F. Akyildiz and Mehmet Can, "Wireless Sensor Networks", John Wiley & Sons Ltd., 2010.
3. Mohammad Ilyas and ImadMahgoub, "Handbook of sensor networks : Compact wireless and wired sensing systems", CRC Press LLC, 2005.

213INT1302	DIGITAL IMAGE PROCESSING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	To introduce the basic concepts and methodologies for analysis, modeling, synthesis and coding of speech and music and to provide a foundation for developing applications and for further study in the field of digital audio standards and its techniques						

Course Outcome(s)	
CO1	Explain the basic concepts like sampling, image representation
CO2	Carry various transformations on images and restore them
CO3	Enhance the images using various filtering techniques for the region of interest
CO4	Apply various segmentation techniques on digital images
CO5	Describe various representations of digital images

Mapping of COs with Pos

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

Course Topic(s)

Unit 1 : Image Processing Fundamentals

Advantages, Applications, Limitations of DIP; Components of an image processing system, Digital image representation, light, hue, saturation and intensity, grey scale and colour images, colour models; Basic relationship between pixels, image sampling and quantization

Unit 2: Image Transforms, Image Restoration

Two dimensional orthogonal transforms - DFT, FFT, Walsh, Slant, Hadamard, Haar transform, KLT, DCT, wavelets; Image degradation: Spatial domain, frequency domain; Degradation model for continuous function, continuous impulse function, restoration approaches: unconstrained restoration, constrained restoration, Lagrange multiplier, minimum mean square error filtering, constrained least square filtering, inverse filtering, removal of blur caused by uniform linear motion, Wiener filter, Geometric mean filter, Geometrical transformations

Unit 3: Image Enhancement

Image enhancement in the Spatial Domain, background, basic grey level transformations, histogram processing, enhancement using arithmetic/logic operations, basic of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods,

image enhancement in the frequency domain -background, introduction to Fourier transform and frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, homomorphic filters, implementation

Unit 4 : Image Segmentation

Detection of discontinuities, edge linking and boundary detection, threshold, region-based segmentation, segmentation by morphological watersheds, use of motion in segmentation

Unit 5: Image Representation

Image representation, Boundary representation using chain codes, Polygonal approximation, signatures, skeleton, patters, recognition based on decision theoretic methods

Text Book(s):

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, 3rd Edition, 2013

Reference(s):

1. Anil. K. Jain, Fundamentals of Digital Image Processing, PHI, 2001
2. William K. Pratt, Digital image processing: PIKS Scientific Inside, Wiley, 4th Edition, 2012

213INT2309	REAL TIME SYSTEMS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Operating Systems Concepts (212INT2302)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• Explain and apply the fundamental concepts and terminology of real-time systems. • Explain and address the fundamental problems of real-time systems. • Analyze real-time systems designs. • Design a real-time system. • Identify and assess the relevant literature and research trends of real-time systems						
Course Outcome(s)							
CO1	Understand the basics and importance of real-time systems						
CO2	Implement a high-level analysis document based on requirements specifications						
CO3	Implement a high-level design document based on analysis documentation						
CO4	Implement a test plan based on requirements specification						
CO5	Implement a validation plan based on all documentation						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											2		
CO2	1	3	3	2	2									1	
CO3	1	3	3	2	2						1	1			2
CO4		3	2								1			3	
CO5		3	2		2					1	1		2		

Course Topic(s)

UNIT 1: INTRODUCTION

Introduction-Issues in real time computing-Architecture of Real time Systems and Embedded Systems – Operating Systems issues – Performance Measures – Estimating Program runtimes.

UNIT 2: TASK ASSIGNMENT AND SCHEDULING

Classical uniprocessor Scheduling algorithms - uniprocessor Scheduling of IRIS Tasks – Tasks Assignment -Mode charges -Fault tolerant scheduling.

UNIT 3: PROGRAMMING LANGUAGES AND TOOLS

Desired language characteristics based on ADA – Data typs – Control Structures – Packages – Exception Handling – Overloading – Multitasking – Timing specification – Task Scheduling – Just-intime Compilation – Runtime support.

UNIT 4 : REAL TIME DATA BASES

Basic networking principles – Real time databases –Real time Vs general purpose data base- Transaction processing – Concurrency control – Disk scheduling algorithms – Serialization and Consistency-Data base for hard real time systems.

UNIT 5: FAULT TOLERANCE, RELIABILITY AND SYNCHRONIZATION

Fault types – Fault detection and containment – Redundancy – Data diversity – Reversal checks – Obtaining parameter values – Reliability models for hardware redundancy – Software error models – Clocks – Fault tolerant synchronization – Synchronization in software.

TEXT BOOK

1. Krishna C.M., Kang G.Shin, "Real -Time Systems", McGraw-Hill, International Editions, 2010.

REFERENCES

2. Raymond J.A. Buhr, Donald L. Bailey, "An Introduction To Real Time Systems", Prentice Hall International, 1999.
3. Stuart Bennett, "Real Time computer control-An Introduction", PHI, 2004.

213INT3309	INDUSTRIAL IoT	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn about the fundamentals of Internet of Things • To build a small low cost embedded system using Arduino/ Raspberry Pi or equivalent boards • To apply the concept of Internet of Things in real world scenario						
Course Outcome(s)							
CO1	Design a portable IoT using Arduino/Equivalent boards and relevant protocols						
CO2	Develop web services to access/control IoT devices						
CO3	Analyze the various components of IoT						
CO4	Analyze applications of IoT in real time scenario						
CO5	Deploy an IoT application and connect to the cloud						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3		3	3								2		
CO2	1	3	2	2			3			3				1	
CO3	1	3				3									2
CO4	1	3	2	3							3			3	
CO5	1	3	2	1			3						2		

Course Topic(s)

Unit I Introduction

IIoT-Introduction, Industrial IoT: Business Model and RefereceArchiterture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.

Unit II IIoT Analytics

Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop.

Unit III IIoT Security

Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT,

Security in IIoT.

Unit IV Robotics

Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer, Digital Camera.

Unit V Case Study

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies : Milk Processing and Packaging Industries, Manufacturing Industries.

Text Books

1. Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress), 2017.
2. AnisKoubaa, "Robot Operating System (ROS) The Complete Reference", First Volume, Springer, 2016

Reference Books

1. "Industrial Internet of Things: CybermanufacturingSystems"by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017
2. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.

213INT1106	SIGNALS AND SYSTEMS	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Theory						

CO1	Identify different types of continuous time and discrete time signals.
CO2	Identify different types of continuous time and discrete time systems.
CO3	Analyze signals using Z Transform and FT.
CO4	Analyze signals using DFT and FFT
CO5	Appreciate different Digital Filter structures

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1 : BASICS OF SIGNALS

Basic operations on signals, continuous time and discrete time signals: step, impulse, ramp, exponential and sinusoidal functions

UNIT 2: BASICS OF SYSTEMS

Continuous time and discrete time systems, properties of systems: linearity, causality, time invariance, memory, stability, invertibility. Linear time invariant systems, convolution

UNIT 3 : Z-TRANSFORM

Z-transform, region of convergence, properties of Z-transform, inverse Z-transform.

UNIT 4: FOURIER TRANSFORM

Fourier transform (FT) of discrete time signals, properties of FT, relation between Z-transform and FT.

Unit 5: DFT

Discrete Fourier transform (DFT), Properties of DFT, inverse DFT, Fast Fourier transform (FFT), Radix-2 FFT algorithms, butterfly structure

Text Book(s):

1. Tarun Kumar Rawat, "Signals and Systems", Oxford University Press, 2010.
2. V. Krishnaveni, A. Rajeswari, "Signals and Systems", Wiley, 2012

Reference(s):

1. Michael J Roberts and Govind Sharma, "Signals and Systems", McGraw Hill, 2010
2. M. N. Bandyopadhyaya, "Introduction to Signals and Systems and Digital Signal Processing", PHI, 2008

213INT1308	PRINCIPLES OF DIGITAL SIGNAL PROCESSING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• The basic concepts and techniques for processing signals on a computer. • Signals, systems, time and frequency domain concepts which are associated with the mathematical tools (i.e.) fundamental to all DSP techniques. • To provide a thorough understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals. • To study various sampling techniques and different types of filters and will also understand Basic principles of Estimation Theory. • The most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.						
Course Outcome(s)							
CO1	Analyze and process signals in the discrete domain						
CO2	Analyze signals using fast fourier transform						
CO3	Design IIR Filters to suit specific requirements for specific applications						
CO4	Design FIR Filters to suit specific requirements for specific applications						
CO5	Design and develop applications of signal processing algorithms to suite specific needs						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3											2		
CO2	1	2	3											1	
CO3	1	2	3												2
CO4	2	2										1		3	
CO5	3	2	1				1	2				2	2		

Course Topic(s)

UNIT 1 : SIGNALS AND SYSTEMS

Basic elements of digital signal Processing – Concept of frequency in continuous time and discrete time signals – Sampling theorem – Discrete time signals, Discrete time systems – Analysis of Linear time invariant systems – Z transform –Convolution and correlation - MATLAB programs for signals and systems.

UNIT 2 : FAST FOURIER TRANSFORMS

Introduction to DFT – Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency

algorithms –Use of FFT algorithms in Linear Filtering.

UNIT 3 : IIR FILTER DESIGN

Structure of IIR – Analog filter design - Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – Design of IIR filter in the Frequency domain.

UNIT 4 : FIR FILTER DESIGN

Structure for FIR systems - Symmetric & Anti-symmetric FIR filters – Linear phase FIR filter – Filter design using windowing techniques (Rectangular Window, Kaiser Window), Frequency sampling techniques - Finite word length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.

UNIT 5: APPLICATION OF DSP

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor –Application of DSP: Model of speech wave form – Vocoder – Musical sound processing, Digital music synthesis.

TEXT BOOK

1. John G. Proakis& Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

REFERENCES

1. Alan V Oppenheim, Ronald W Schafer and John R Buck, "Discrete Time Signal Processing", PHI/Pearson Education, 2010.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

PRACTICAL EXPERIMENTS

1. Generation of input Signals.
2. Analysis of linear system [with convolution and de-convolution operation]
3. FIR filters design by Rectangular window using MATLAB Programming.
4. FIR filters design by Kaiser Window using MATLAB Programming.
5. IIR Butterworth filters design using MATLAB Programming.
6. IIR Chebyshev filters design using MATLAB Programming.
7. Implementation of FFT
8. Implementation of Interpolation and decimation
9. Estimation of power spectral density using MATLAB Programming
10. Spectral analysis using MATLAB Programming
11. Verification of linear phase characteristics of FIR filters .

NETWORK MANAGEMENT

213INT3310	NETWORK DESIGN SECURITYAND MANAGEMENT	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To know about System Level Security, Vulnerabilities & threats • To understand the concepts of Encryption Algorithms & Techniques, Authentication functions, Protocols & Tools, • To analyze the Security principles based on OSI Architecture, Wireless Security, Network design including LAN and WAN & Network Management						
Course Outcome(s)							
CO1	Understand the basic concepts of network design						
CO2	Illustrate the process of network design						
CO3	Apply authentication techniques to provide secure communication						
CO4	Analyze public cryptosystems for the quality of security						
CO5	Understand the concepts of various Network Management Services						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	1										2		
CO2		2	2		3					3		1		1	
CO3				3	3										2
CO4		3	1			3						1		3	
CO5		3	2					3					2		

Course Topic(s)

UNIT 1: INTRODUCTION

Overview of Design process - Process Components, System description, Service Description, Service, Performance Characteristics, Network Supportability. Requirement Analysis – User requirement, Application requirement, Device requirement, Network requirement.

UNIT 2: DESIGN CONCEPTS

Design Concepts – Objectives, process, Service provider Evaluation, Network Layout, Trace Traceability, Design Metrics.

UNIT 3: SECURITY PROBLEM AND CRYPTOGRAPHY

Security attacks – services – and mechanism – Conventional encryption model – Steganography – classical encryption techniques – simplified DES – block Cipher principles – The DESstandards – Principles of Public key cryptosystems – RSA algorithm – Key management –

Hellman key exchange – Authentication requirements and functions – Authentication codes Hash functions Kerberos. Practical: DES, RSA, Hellman algorithms

UNIT 4: NETWORK SECURITY

Transport level Security- Web Security, SSL, TLS, HTTPS, SSH- Wireless network security-E Mail security-PGP, S/ MIME, DKIM, IP Security, Intrusion detection – password management. Malicious software– Viruses and related Threats – Virus Counter measures , worms, DDoS attacks– Firewall Design Principles – Trusted Systems. Practical: PGP, S/ MIME, DKIM

UNIT 5: NETWORK MANAGEMENT

Network management – requirements and systems – Network monitoring architecture – Performance monitoring – Fault monitoring – Account monitoring – Configuration control – Security control – SNMP background and concepts – structure of management information – SNMP protocol – Basic concepts – specifications – Transport level support Groups. Practical: Network Monitoring

TEXT BOOKS

1. "Network Analysis, Architecture, and Design" (3rd Edition), James McCabe, Morgan Kaufmann Publishers, 3rd edition, 2011
2. William Stallings, "Cryptography and Network Security", 6th Edition, PearsonEducation, March 2013.
3. William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Pearson education Asia, 2009.

REFERENCES

1. Charles P. Pfleeger, "Security in Computing", Prentice Hall, 3rd Edition 2003.
2. Bruce Schneier, "Applied Cryptography", JohnWiley& Sons Inc, 2nd edition, 2007.
3. Mani Subramanian, "Network management – Principle and practice", Pearson education India, 2010.

213INT1309	INFORMATION SECURITY	L	T	P	X	C	H
		3	0	2	0	4	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• Apply the basic security algorithms and policies required by computing system. • Predict the vulnerabilities across any computing system and hence be able to design a security solution for any computing system.						
Course Outcome(s)							
CO1	To introduce the concepts and models of security in computing.						
CO2	To design and implement symmetric and asymmetric cryptosystems.						
CO3	To explain the security standards followed at the network level and at theapplication level.						
CO4	To estimate the level of security risk faced by an organization and the counter measures to handle the risk.						
CO5	To know about the software security development model.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3									1	2		
CO2		3		3			3					1		1	
CO3		3		3		3	3								2
CO4			3									1		3	
CO5		3	2			3						1	2		

Course Topic(s)

UNIT 1: SECURITY - AN OVERVIEW

Basics of Security - CIA Triad - Threats, Attacks and Controls - Security Models- Bell-LaPadula model - Biba Integrity model - Chinese Wall model - Malicious Logic - Viruses, Worms, Logic Bombs - Basics of Cryptography - Mathematics for Cryptography - Modulo Arithmetic - Euclidean and extended Euclidean Theorem - Chinese Remainder Theorem - Euler and Fermat theorem - Classical Cryptosystems - Substitution and Transposition.

UNIT 2: ADVANCED CRYPTOGRAPHY

DES and AES - Public Key Cryptography - RSA and ElGamal algorithms - Authentication and Key Exchange - Biometric authentication - Diffie Hellman and Needem Schroeder algorithms - Elliptic Curve Cryptosystems - Digital Signatures - Message Digest - Certificates - Directories and Revocation of keys and certificates.

UNIT 3: SECURITY STANDARDS

Public Key Infrastructure - Kerberos - X.509 - IPSec - Virtual Private Networks - E-Mail Security - PGP and PEM - Web Security - Secured DNS - SSL, TLS and SET - CoBITFramework - Compliances - Credit Card Applications - GLBA.

UNIT 4: SECURITY PRACTICES

Vulnerability Analysis - Flaw Hypothesis Methodology, NRL taxonomy and Aslam's model - Auditing - Anatomy of an Auditing System - Design of Auditing Systems - Posteriori Design - Auditing mechanisms - Risk Analysis and Management - Disaster Recovery Planning/Incident Response Planning.

UNIT 5: SECURE DEVELOPMENT

Secure Coding - OWASP/SANS Top Vulnerabilities - Buffer Overflows - Incomplete mediation - XSS - Anti Cross Site Scripting Libraries - Canonical Data Format - Command Injection - Redirection - Inference – Application Controls - Secured Software Development Life Cycle - Evaluation of Security Systems- Case Studies-Legal and Ethical Issues- Cybercrime and computer crime - Intellectual property-Copyright, patent, trade secret - Hacking and Intrusion privacy-Identity theft.

TEXT BOOKS:

1. Charles Pfleeger, Shari Lawrence Pfleeger, Devin N Paul, ―Security in Computing ‖,Pearson, 2007.

2. William Stallings, ―Cryptography and Network Security – Principles and Practices‖, Pearson Education, Sixth Edition, 2013.

REFERENCES:

1. Wade Trappe, Lawrence C Washington, ―Introduction to Cryptography with Coding and Theory‖, Second Edition, Pearson, 2007.

2. Wenbo Mao, ―Modern Cryptography Theory and Practice‖, Pearson, 2004.

4. Behrouz A Forouzan and DebdeepMukhopadhyay, "Cryptography and Network Security", Tata Mc Graw Hill Ltd. 2014.

213INT3311	MOBILE NETWORKS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	This Course Describes about routing mechanisms for both Adhoc and Sensor Networks						
Course Outcome(s)							
CO1	Understand the basics of radio access and networks						
CO2	Learn to simulate wireless networks and analyze the simulation results						
CO3	Describe the concepts of ad hoc networks, design and implementation issues, and available solutions						
CO4	Apply knowledge of wireless sensor networks to various application areas						
CO5	Demonstrate advanced knowledge of networking and wireless networking						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	3										2		
CO2	3					2								1	
CO3		3													2
CO4		3			1									3	
CO5							3			3	3	1	2		

Course Topic(s)

UNIT 1: MULTIPLE RADIO ACCESS

Medium Access Alternatives: Fixed-Assignment for Voice Oriented Networks Random Access for Data Oriented Networks, Handoff and Roaming Support, Security and Privacy.

UNIT 2: WIRELESS BROADBAND NETWORKS TECHNOLOGY & PLATFORMS

Wireless broadband fundamentals and Fixed Wireless Broadband Systems - Platforms- Enhanced Copper- Fibre Optic and HFC - 3G Cellular- Satellites - ATM and Relay Technologies**UNIT 3: AD HOC NETWORKS**

Characteristics and Applications of Ad hoc Networks - Routing – Need for routing and routing classifications - Table Driven Routing Protocols - Source Initiated On-Demand Routing Protocols - Hybrid Protocols – Zone Routing - Fisheye Routing - LANMAR for MANET with group mobility - Location Added Routing, Distance Routing Effects - Micro discovery and

Power Aware Routing. Practical : Routing Protocols

UNIT 4: SENSOR NETWORKS

Wireless Sensor Networks - DARPA Efforts –Classification - Fundamentals of MAC - Flat routing – Directed Diffusion-SPIN - COGUR - Hierarchical Routing - Cluster base routing - Scalable Coordination – LEACH – TEEN - APTEEN and Adapting to the dynamic nature of Wireless Sensor Networks. Practical : MAC protocols

UNIT 5: ADVANCED WIRELESS NETWORKS

Key Management in Sensor Network, Intrusion detection in sensor Networks, Security in RFID devices, Security in Adhoc Networks, Human – centered cyber security

TEXT BOOK

1. John R. Vacca, "Wireless Broadband Networks Handbook 3G, LMDS and Wireless Internet", Tata McGraw-Hill, 2001.

REFERENCES

1. Agrawal D.P., and Qing-Anzeng, "Introduction to Wireless and Mobile Systems", Thomson Learning, 3rd Edition, 2010.
2. Martyn Mallick, "Mobile and Wireless Design Essentials, Wiley publication, 2003.
3. KaveshPahlavan and Prashant Krishnamurty, "Principles of Wireless Networks – A unified Approach", Prentice Hall PTR, 2002

213INT3101	WIRELESS APPLICATION PROTOCOL	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	• To learn the basic concepts of mobile internet • To introduce the web technologies for developing simple web applications. • To make students to understand about services of WAP and to learn WAP programming languages used for WAP service implementation. • To teach the concepts for deploying WAP services • To understand about wireless telephony applications and its enhancements						
Course Outcome(s)							
CO1	Understand the basic concepts of mobile internet , services and service providers of mobile internet.						
CO2	Learn about the web technologies used for developing web applications and components.						
CO3	Analyze about the WAP services and to learn programming language used for developing WAP services.						
CO4	Analyzing how WAP services are linked with internet and about internet protocols.						
CO5	Learn about wireless telephony applications, design considerations for applications.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										2		
CO2		3	3		3							1		1	
CO3		2	1		3										2
CO4		2	1				3							3	
CO5		2	3									1	2		

Course Topic(s)

UNIT 1: MOBILE INTERNET

Introduction, Mobile Data – connectivity – Key services for mobile internet – Mobile Internet access and application service provides - Content providers and Developer.

UNIT 2: MOBILE INTERNET STANDARD

Current Web technologies for wireless application - origin and overview of WAP components of wap standard - Network Infrastructure services supporting Wap clients Design Principles Tools

and software editors and emulators.

UNIT 3: IMPLEMENTING WAP SERVICES

WML Basic and Document model - content generation - Binary WML - enhanced WML - WML script - rules of script standard libraries - user interface design guidelines.

UNIT 4: ADVANCED WAP

Tailoring content to client - Techniques using HTTP 1.1 - WAP Push - Push Access Protocol - Push Technology - MIME media types for push messages - Proxy gateway; Data base driven WAP - ASP and WAP - Object model - Activex data objects (ADO) - End-to-End WAP services - Security domains - linking WAP and internet.

UNIT 5: WIRELESS TELEPHONY APPLICATIONS

WTA architecture - client Framework - Server and security - Design considerations Application creation Toolbox - WTA enhancements – Technology - Bluetooth and voice XML - Telematics inter connectivity.

TEXT BOOK

1. Sandeep Signal et al, “Writing Applications for Mobile Internet”, Pearson Education, 2001.

REFERENCE

1. “Wireless Protocols - A beginner’s Guide” BulBrook, Tata McGraw Hill PCL, 2001.

213INT3312	HIGH PERFORMANCE NETWORKS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To facilitate the students on the basis of ATM and Frame relay concepts and explain the various types of LAN's and to know about their applications. • To learn about network security in many layers and network management • To study the types of VPN and tunneling protocols for security. • To develop a comprehensive understanding of multimedia networking.						
Course Outcome(s)							
CO1	Implement different operations in communication networks						
CO2	Understand the flow control and congestion control during packet transmission						
CO3	Understand switching in ATM and Frame Relay networks						
CO4	Study about the differnet queuing methods						
CO5	Know the different protocols towards Quality of Service						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3		3	3								2		
CO2	1	3	2	2			3			3				1	
CO3	1	3				3									2
CO4	1	3	2	3							3			3	
CO5	1	3	2	1			3						2		

Course Topic(s)

UNIT 1: HIGH SPEED NETWORKS

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

UNIT 2: CONGESTION AND TRAFFIC MANAGEMENT

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT 3: TCP AND ATM CONGESTION CONTROL

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management. **UNIT 4: INTEGRATED AND DIFFERENTIATED SERVICES**

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

UNIT 5: PROTOCOLS FOR QOS SUPPORT

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

TEXT BOOK

1. William Stallings, "High Speed Networks And Internet", Pearson Education, Second Edition, 2010.

REFERENCES

1. Warland&PravinVaraiya, "High Performance Communication Networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN Architecture", Cisco Press, Volume 1 and 2, 2003.

213INT3313	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	To develop a fundamental understanding of Cryptography and network security proper practices, policies, technologies and standards.						
Course Outcome(s)							
CO1	Explain the foundations of cryptography and network security.						
CO2	Identify common security vulnerability attacks in different networking environment						
CO3	Evaluate the risks and threats to digital communication system						
CO4	Demonstrate the detailed knowledge of the role of encryption to protect the data						
CO5	Explain the fundamental concepts of different digital signature schemes						
CO6	Identify the appropriate cryptographic scheme and security mechanism for different computing environment and information systems						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1			1								2		
CO2	3	3			1	3								1	
CO3	3	3		1	1										2
CO4	3	1					3							3	
CO5	3	3											2		

Course Topic(s)

UNIT 1: INTRODUCTION

Introduction-OSI Security Architecture - Classical Encryption techniques – Block Cipher Principles –

Data Encryption Standard- Basic concepts in number theory and finite fields – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES. Practical: DES

UNIT 2: PUBLIC KEY CRYPTOGRAPHY

Number Theory- Public Key Cryptography and RSA-Key Management - Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography –Public Key Cryptosystem-Confidentiality using Symmetric Encryption and Asymmetric Encryption. Practical: RSA, Diffie Hellman

UNIT 3: CRYPTOGRAPHIC AND DATA INTEGRITY ALGORITHMS

Applications of cryptographic hash functions- Simple Hash Functions- Requirements and security- Secured Hash Algorithm- Message Authentication requirements and functions – Message Authentication Codes – Security of MACs – HMAC- Digital Signatures – ElGamal Digital signature scheme- Schnorr Digital signature scheme - Digital Signature Standard. Practical: Secured Hash Algorithm- Cryptography and Authentication

UNIT 4: NETWORK AND INTERNET SECURITY

Transport level Security- Web Security, SSL, TLS, HTTPS, SSH- System Implementation- Wireless network security-E Mail security-PGP, S/ MIME, DKIM, IP Security. Practical: PGP

UNIT 5: SYSTEM LEVEL SECURITY

Intrusion detection – password management. Malicious software– Viruses and related Threats – Virus Counter measures , worms, DDoS attacks– Firewall Design Principles – Network Security - Trusted Systems. Practical: password management

TEXT BOOK

1. William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education, March 2013.

REFERENCES

1. Bruce Schneier, "Applied Cryptography", second edition, John Wiley & Sons, New York, 2007.
2. Chris Brenton, "Mastering Network Security", BPB Publication, New Delhi, 2002.
3. Behrouz A Forouzan , "Cryptography and Network Security", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014.

213INT1107	CYBER PHYSICAL SYSTEM	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	• To understand the fundamentals of Computer Forensics and computing Investigations. • To recognize the legal underpinnings and critical laws affecting forensics. • To apply the tools and methods to uncover hidden information in digital systems. • To learn about current licensing and certification requirements to build the career in digital forensic.						
Course Outcome(s)							
CO1	Understand of the role of computer forensics						
CO2	Identify some of the current techniques and tools						
CO3	Describe and identify basic principles of good professional practice for a forensic computing practitioner						
CO4	Demonstrate an understanding of issues related to privacy and determine how to address them technically and ethically.						
CO5	Apply some forensic tools in different situations.						

Mapping of COs with Pos														
COs	PO's											PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				1			1	2		
CO2		2			3				3					1	
CO3	1	3		3			2				3				2
CO4				2	3			3				2		3	
CO5		3				3					3		2		

Course Topic(s)

UNIT 1: NTRODUCTION

The Scope of Computer Forensics - Windows Operating and File Systems –Handling Computer Hardware – Anatomy of Digital Investigation.

UNIT 2: INVESTIGATIVE SMART PRACTICES

Forensics Investigative Smart Practices – Time and Forensics – Incident closure

UNIT 3: LAWS AND PRIVACY CONCERNS

Laws Affecting Forensic Investigations – Search Warrants and Subpoenas – Legislated Privacy Concerns – The admissibility of Evidence – First Response and Digital Investigator

UNIT 4: DATA ACQUISITION AND REPORT WRITING

Data Acquisition – Finding Lost Files – Document Analysis – Case Management and Report Writing – Building a Forensics Workstation

UNIT 5: TOOLS AND CASE STUDIES

Tools of the Digital Investigator - Licensing and Certification – Case Studies: E-mail Forensics – Web Forensics – Searching the Network – Excavating a Cloud – Mobile device Forensics.

TEXTBOOKS:

1. Michael Graves, "Digital Archaeology: The Art and Science of Digital Forensics", Addison-Wesley Professional, 2014.
2. Darren R. Hayes, "Practical Guide to Computer Forensics Investigation", Pearson, 2015.
3. Albert J. Marcella and Frederic Guillossou, "Cyber Forensics: From Data to Digital Evidence " Wiley, 2015.

REFERENCE:

1. Bill Nelson, Amelia Phillips and Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Cengage Learning, 2013**.**

213INT1310	Blockchain Technology	L	T	P	X	C	H
		3	0	2	0	4	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	By the end of the course, students will be able to • Understand how blockchain systems (mainly Bitcoin and Ethereum) work, • To securely interact with them, • Design, build, and deploy smart contracts and distributed applications, • Integrate ideas from blockchain technology into their own projects.						
Course Outcome(s)							
CO1	Explain design principles of Bitcoin and Ethereum.						
CO2	Explain the Simplified Payment Verification protocol.						
CO3	Interact with a blockchain system by sending and reading transactions.						
CO4	Design, build, and deploy a distributed application.						
CO5	Evaluate security, privacy, and efficiency of a given blockchain system						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3		3	3								2		
CO2	1	3	2	2			3			3				1	
CO3	1	3				3									2
CO4	1	3	2	3							3			3	
CO5	1	3	2	1			3						2		

Course Topic(s)

Unit I Introduction

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.

Unit II Cryptography

Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof. Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit III Distributed Consensus

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil

Attack, Energy utilization and alternate. Cryptocurrency- History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

Unit IV Cryptocurrency Regulations

Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market and Global Economy.

Unit V Blockchain Applications

Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain

Text Books

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press.

Reference Books

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.

213INT1108	5G Networks	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	(i) The enabling technologies of the 5G-EVE ICT-17 platform, (ii) The fundamental enablers of the Phase-2 5GPPP projects 5G-MoNArch and 5G-Xcast, and (iii) Novel machine learning functionalities developed within 5G-TOURS for the operation of large-scale networks; the architecture will take into account security and privacy by design requirements.						
Course Outcome(s)							
CO1	Understand the basic principles of wireless communication, network configuration and virtualization beyond the 5G internet						
CO2	Understand the small cells technology and co-operation for next generation networks.						
CO3	Understand the basic architecture, deployment and their communication of 5G networks						
CO4	Compare and explain various radio access technologies for 5G networks						
CO5	Describe and explain the evolution of 5G, system concepts and spectrum challenges						

Mapping of COs with Pos														
COs	PO's											PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				1			1	2		
CO2		2			3				3					1	
CO3	1	3		3			2				3				2
CO4				2	3			3				2		3	
CO5		3				3					3		2		

Course Topic(s)

UNIT - I DRIVERS FOR 5G

Introduction – Historical trend of wireless communication – Evolution of LTE Technology to Beyond 4G.THE 5G INTERNET – Internet of Things and context – Awareness – Network Reconfiguration and Virtualization support – Mobility – quality of Service Control – Emerging approach for resource over provisioning

UNIT-II SMALL CELLS FOR 5G MOBILE NETWORKS

Introduction – Small Cells – Capacity limits and Achievable gains with densification – Mobile data demand – Demand vs Capacity – small cell challenges. CO-OPERATION FOR NEXT GENERATION WIRELESS NETWORKS – Introduction – cooperative diversity and relaying strategies – PHY Layer Impact – MAC protocol analysis.

UNIT – III 5G ARCHITECTURE

Introduction – High level requirements for 5G architecture – Fundamentals architecture and 5G flexibility – Physical Architecture and 5G deployment. DEVICE TO DEVICE D2D COMMUNICATION – D2D: from 4G to 5G – Radio resource management for mobile brand D2D – Multihop D2D communications for proximity and emergency services – Multi-operator D2D communications.

UNIT – IV THE 5G RADIO ACCESS METHODOLOGIES

Access design principles for multiuser communications – Multicarrier with filtering; a waveform – Non – orthogonal schemes for efficient multiple access – Radio access for dense deployments – Radio access for V2x communication – Radio access for massive machine type communications.

UNIT – V SPECTRUM

Introduction – 5G spectrum landscape and requirements – Spectrum access modes and sharing scenarios.5G spectrum technologies – value of spectrum for 5G : a techno – economic perspectives THE 5G WIRELESS PROPAGATION CHANNEL MODE – Introduction – Modeling requirements and scenarios – the METIS channel models.

REFERENCES

1. Fundamentals of 5G mobile Networks, edited by Jonathan RodisQuez and Wiley
2. 5G Mobile and Wireless Communications TechnologybyAfifOsseiran(ed.) ; Jose F. Monserrat(ed.) ; Patrick Marsch(ed.) ; Mischa Dohler(other) ; Takehiro Nakamura(other) june 2016.
3. William Stallings, “Wireless Communication and Networks”, Pearson Education,2003.
4. Singhal, “WAP-Wireless Application Protocol”, Pearson Education, 2003.
5. LotherMerk, Martin.S.Nicklaus and Thomas Stober, “Principle of Mobile Computing”, Second Edition, Springer, 2003.
6. William C.Y.Lee, “Mobile Communication Design Fundamentals”, John Wiley,1993
7. Roy Blake, “Wireless Communication Technology”, India edition, Cengage learning. 2010.
8. UpenaDalal “Wireless Communication”,Oxford Higher education, First Edition, 2009.
9. Raj Kamal, “Mobile Computing”,Oxford Higher education, Second Edition, 2002.
10. J.Schiller, “Mobile Communication”, Addison Wesley, 2000.

COMPUTING STREAM

213INT2307	DISTRIBUTED SYSTEMS	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Computer Organization and Assembly Language Programming (212INT1101)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To expose students to both the abstraction and details of file systems. • To introduce concepts related to distributed computing systems. • To focus on performance and flexibility issues related to systems design decisions. • To expose students to current literature in distributed systems.						
Course Outcome(s)							
CO1	Understand various models of distributed systems						
CO2	Aware of distributed file systems						
CO3	Identify the needs of distributed systems implementation						
CO4	Construct work flows as such in distributed systems						
CO5	Design distributed systems						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	1		3			2	1		3		2		
CO2		2	3					2	3					1	
CO3		3	2		1			3	2		1				2
CO4			2	1					2	1				3	
CO5						1							2		

Course Topic(s)

UNIT 1: INTRODUCTION

Characterization of Distributed Systems- Examples of distributed systems - Challenges-System Models-Physical models-Architectural models - Fundamental models - Introduction to inter- process communications-External data representation and marshalling- Multicast communication- Network virtualization -Overlay networks – Practical : MPI and World Wide Web, Remote MethodInvocation program

UNIT 2: DISTRIBUTED OBJECTS AND FILE SYSTEM

Introduction - Distributed objects -From objects to components-Case studies: Enterprise JavaBeans and Fractal - Introduction to DFS - File service architecture - Sun network file system -The Andrew File System- Introduction to Name Services- Name services and DNS - Directory and directory services Practical : The Global Name Service, The X.500 Directory Service.

UNIT 3: DISTRIBUTED OPERATING SYSTEM SUPPORT

The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Virtualization at the operating system level - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical Clocks - Global states - Distributed debugging. Practical :CORBA using Java program, Java deadlock program

UNIT 4: TRANSACTION AND CONCURRENCY CONTROL – DISTRIBUTED TRANSACTIONS

Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery. Practical: Concurrency control using DBMS

UNIT 5: DISTRIBUTED SYSTEM DESIGN AND DISTRIBUTED MULTIMEDIA SYSTEMS

Introducing the case study: Google- Overall architecture and design philosophy- Underlying communication paradigms- Data storage and coordination services- Distributed computation services- Introduction to distributed multimedia systems- Characteristics of multimedia data - Quality of service management - Resource management- Stream adaptation- Practical : Tiger, BitTorrent and End System Multicast.

TEXT BOOK

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Addison Wesley, May 2011.

REFERENCES

1. A.S.Tanenbaum, M.Van Steen, "Distributed systems: principles and paradigms",PearsonPrentice Hall, 3rd Edition, 2007.
2. MukeshSinghal, "Advanced Concepts In Operating Systems", McGraw-Hill Series in Computer Science, Ohio State University, Columbus 2001.

213INT2304	FORMAL LANGUAGE AND AUTOMATA	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To introduce students about the mathematical foundations of computation including automata theory, the theory of formal languages and grammars, the notions of algorithm, decidability, complexity, and computability, • To enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.						
Course Outcome(s)							
CO1	Design the Finite Automata, Deterministic Finite Automata and Non Deterministic Finite Automata						
CO2	Understand the Regular languages and expressions to given a problem						
CO3	Apply the context free grammar (CFG) to describe programming languages and evaluate the equivalence of push down automata and CFG.						
CO4	Design the Turing machine for different languages and simple computations						
CO5	Analyze the Undecidable problem in regular expression and Turing machine						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3		3			2						2		
CO2	1		3											1	
CO3	1			3											2
CO4	1				3		2				3			3	
CO5	1	3	3				2					2	2		

Course Topic(s)

UNIT 1: 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 2: 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 and Minimization of Automata

UNIT 3: CONTEXT-FREE GRAMMAR AND PUSH DOWN AUTOMATA

Context-Free Grammar (CFG) – Application- Parse Trees – Ambiguity in Grammars and

Languages – Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG - Deterministic Pushdown Automata

UNIT 4: PROPERTIES OF CFL AND TURING MACHINE

Normal Forms for CFG – Pumping Lemma for CFL –Applications Properties of CFL –Turing Machines – Programming Techniques for TM: Multiple Stacks, Subroutines-Extensions to the Basic Turing Machine

UNIT 5: UNDECIDABILITY

A language that is not Recursively Enumerable (RE) – An Undecidable problem that is RE – Undecidable Problems about Turing Machine – Post_s Correspondence Problem - The classes P and NP - NP complete-Complements of Languages in NP

PRACTICE COMPONENTS

. Create the Deterministic Finite Automata using JFLAP simulator

2. Create the Non-Deterministic Finite Automata using JFLAP simulator

3. Construct a regular expression using JFLAP. Use Convert→Convert FA to RE.

4. Construct a Grammar using JFLAP.

5. Convert regular expressions to FA

6. Create Regular Grammar and convert to Finite Automaton

7.Create a PDA that accepts strings that contains the language L = {axcb2x | where $x \geq 0$} using the alphabet Σ = {a,b,c}.

8. Create each PDA with at least five test results with the following languages over alphabet: □= {a,b}

a) L = {anbn | where n > 0}

b) L = {anbncn | where n > 0}

9. Construct PDA for any given grammar.

TEXT BOOK

1 Hopcroft J.E,Motwani R and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Third Edition, 2006.

REFERENCE BOOKS

1. Martin J, "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2003

2. Lewis H. R and Papadimitriou C.H , "Elements of The theory of Computation", United States Edition, 1997.

213INT3314	CLOUD COMPUTING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To impart fundamental concepts in the area of cloud computing. • To impart knowledge in developing applications of cloud computing						
Course Outcome(s)							
CO1	Understanding the systems, protocols and mechanisms to support cloud computing						
CO2	Develop applications for cloud computing						
CO3	Understanding the hardware necessary for cloud computing						
CO4	Design and implement a novel cloud computing application						
CO5	Knowledge in various Cloud vendors and their products						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				3				2		
CO2		3	2		1							1		1	
CO3	1	3			2						3				2
CO4		2	3		3			3				3		3	
CO5	1	3										3	2		

Course Topic(s)

UNIT 1: INTRODUCTION

Overview – applications - intranet and cloud - examples: Amazon, Google, Microsoft, IBM – Benefits and Limitations of cloud computing - Google app engine – EMC - NETAPP - Microsoft Azure - Amazon(EC2, S3,SQS) - open stack -cloud computing services

UNIT 2: HARDWARE AND ARCHITECTURE

Clients-Security-Network-Services. Accessing the cloud: Platforms-web applications-web APIs-web browsers. Cloud storage: overview-providers. Standards: application-client-infrastructure-service.

UNIT 3: SOFTWARE AS SERVICE

Overview- Driving forces-company offerings-industries. Software plus services: Overview-mobile device integration-providers-Microsoft Online.

UNIT 4: DEVELOPING APPLICATIONS

Google – Microsoft – IntuitQuickBase - Cast Iron Cloud - Bungee Connect –Development (App engine, Azure, open stack etc.) - trouble shooting and application management.

UNIT 5: LOCAL CLOUDS AND THIN CLIENTS

Virtualization-server solutions-thin clients. Cloud Migration: cloud services for individuals-enterprise cloud- methods for migration-analyzing cloud services.

TEXT BOOKS

3. Anthony T.Velte, Toby Velte, "Cloud Computing a practical approach", Mcgraw Hill, 2010.
4. M.S.V.Janakiram, "Demystifying the Cloud – An introduction to Cloud Computing", version 1.1, 2010.

REFERENCE BOOKS

3. Mark C. Chu-Carroll, "Code in the Cloud- Programming Google App Engine", The Pragmatic Bookshelf Raleigh, North Carolina Dallas, Texas, 2011.
4. Breslin "Cloud Computing: Principles and Paradigms", Wiley Press, New York, USA, 2008.

213INT3315	GREEN COMPUTING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Professional Elective						
Course Type	Integrated Course with Theory						
Objective(s)	This course covers fundamental principles of energy management faced by designers of hardware, operating systems, and data centers. We will explore basic energy management option in individual components such as CPUs, network interfaces, hard drives, memory. We will further present the energy management policies at the operating system level that consider performance vs. energy saving tradeoffs. Finally we will consider large scale data centers where energy management is done at multiple layers from individual components in the system to shutting down entries subset of machines. We will also discuss energy generation and delivery and well as cooling issues in large data centers						
Course Outcome(s)							
CO1	Understand the concepts of technologies that conform to low-power computation						
CO2	Understand green (power-efficient) technologies for components of one single computer, such as CPU, memory and disk, and appreciate cutting edge designs for these components including memory and Registers						
CO3	Have a basic understanding of a variety of technologies applied in building a green system (especially green data centers), including networks, Virtual Machine (VM) management and storage systems						
CO4	Use a range of tools to help monitor and design green systems						
CO5	Analyze the various tools to greening the organization						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2									1	2		
CO2		3					1				2	1		1	
CO3	1	2	2		2										2
CO4					3						3	2		3	
CO5		1		2			3						2		

Course Topic(s)

UNIT 1:ION

Inroduction - Need for Green Computing – Green computing Background – Understanding the World of Green IT: Win-Win-Winning with Green IT – Making the Business Case of Green IT – Green Journeys in Action.

UNIT 2: GETTING A RUNNING START

Getting to know the Standards and Metrics – Assessing your current Energy use and Needs – Go Green in 12 months: Putting Together a plan – Techniques for managing Power consumption

UNIT 3: GREENING THE DATA CENTER

Laying the foundation for green data management – maximizing data center efficiency – Bottom up Electrical Efficiency Improvement - Racking up green servers – cooling your data center – Building a Green Storage System – Grooming the Network for green – Using Virtualization – computer power using Benchmarking – Evaluation of Power Benchmarks

UNIT 4: GREENING THE OFFICE

Moving to Green Screens and Computing Machines – Reducing Desktop Energy Waste – Pursuing the Less-Paper Office – Evaluation Green Gadgetry – Experimental methodology

UNIT 5: GREENING THE ORGANIZATION

Greening the Facility – e-Waste Not, e-Want Not – Virtually There: Collobration Technologies for a Greener World - Ten Organizations that can help with Green IT objectives – Ten creative computer Recycling Tips – Ten tips for a Green Home Office.

TEXT BOOK

1. Carol Baroudi , Jeffery Hill , Arnold Reinhold , JhanaSenxian, " Green IT for dummies", Wiley Publishing Inc, 2009.

REFERENCE

1. MujtabaTalebi, "Computer Power Consumption benchmarking for green computing", ceangage learning, April 2008.

213INT3103	SOCIAL NETWORK ANALYSIS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Information Storage, Modelling and Retrieval (212INT2306)						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	• To gain knowledge about social networks, its structure and social network data sources • To learn the analysis and mining techniques for Social networks • To study about the semantic technologies for social network analysis • To gain knowledge on Visualization of Social networks and its applications						
Course Outcome(s)							
CO1	Learn current web developments in Social Web						
CO2	Understand various mining techniques for social networks						
CO3	Model and represent knowledge for Semantic Web						
CO4	Design extraction and mining tools for Social networks						
CO5	Develop personalized visualization for Social networks						

Mapping of COs with Pos

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

Course Topic(s)

UNIT 1: SOCIAL NETWORK ANALYSIS

Definition and Features - The Development of Social Network Analysis - Basic graph theoretical Concepts of Social Network Analysis – ties, density, path, length, distance, betweenness, centrality, clique - Electronic sources for network analysis - Electronic discussion networks, Blogs and online communities, Web-based networks.

UNIT 2: SOCIAL NETWORK PROFILES

Introduction – types of commercial social network profiles (CSNP) - Quantitative and Qualitative Analysis of CSNPs – Analysis of social networks extracted from log files - Data Mining Methods Related to SNA and Log Mining - Clustering Techniques – Case study.

UNIT 3: SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS

Introduction to ontology-based knowledge representation - - Ontology languages for the Semantic Web – RDF and OWL - Modeling Social network data - State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships.

UNIT 4: SOCIAL NETWORK MINING

Detecting and discovering Communities in Social Networks - Definition of Community - Evaluating Communities - Methods for Community Detection – divisive, spectral and modularity optimization algorithms - Applications of Community Mining Algorithms - Overview of tools for Detecting Communities - Understanding and Predicting Human Behavior for Social Communities.

UNIT 5: VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Visualization of Social Networks - Node-Edge Diagrams - Random Layout - Force-Directed Layout - Tree Layout - Matrix Representations - Hybrid Representations - Visualizing Online Social Networks - Applications - Covert Networks – Community Welfare - Collaboration Networks - Co-Citation Networks.

TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010.

REFERENCES

1. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, 1st edition, 2011.
2. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling", IGI Global snippet, 2009.
3. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

213INT3104	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Information Storage, Modelling and Retrieval (212INT2306)						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	• To learn the concepts behind IR • To understand the operation of web search • To learn the algorithms related to text classification, indexing and searching						
Course Outcome(s)							
CO1	Learn use an open source search engine framework and explore its capabilities						
CO2	Know the various modeling and evaluation techniques						
CO3	Learn to represent documents in different ways and discuss its effect on similarity						
CO4	Learn Calculations and on search						
CO5	Design and implement an innovative feature in a search engine						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		3										2		
CO2	1	3				3					3			1	
CO3	1			3			3			2		1			2
CO4	1	3	2	3					3					3	
CO5	1	3	2								3		2		

Course Topic(s)

UNIT 1: INTRODUCTION

Information Retrieval – Early Developments – The IR Problem – The User's Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT 2: MODELING AND RETRIEVAL EVALUATION

IR models – Classic Information Retrieval – Alternative Set Theoretic Models – Alternative Algebraic Models – Alternative Probabilistic Models – Other Models – Hypertext Models – Web based Models – Retrieval Evaluation – Cranfield Paradigm – Retrieval Metrics – Reference Collections – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback – Clicks – Implicit Feedback Through Local Analysis – Global

Analysis – Documents: Languages & Properties – Queries: Languages & Properties.

UNIT 3: TEXT CLASSIFICATION, INDEXING AND SEARCHING

A Characterization of Text Classification – Unsupervised Algorithms – Supervised Algorithms – Feature Selection or Dimensionality Reduction – Evaluation metrics – Organizing the classes – Indexing and Searching – Inverted Indexes –Signature Files – Suffix Trees & Suffix Arrays – Sequential Searching – Multi-dimensional Indexing.

UNIT 4: WEB RETRIEVAL AND WEB CRAWLING

The Web – Search Engine Architectures – Search Engine Ranking – Managing Web Data – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation - Structured Text Retrieval.

UNIT 5: TYPES OF IR AND APPLICATIONS

Parallel and Distributed IR –Data Partitioning – Parallel IR – Cluster-based IR – Distributed IR - Multimedia Information Retrieval – Challenges – Content Based Image Retrieval – Audioand Music Retrieval – Retrieving and Browsing Video – Fusion Models – Segmentation – Compression - Enterprise Search –Tasks – Architecture of Enterprise Search Systems – Enterprise Search Evaluation - Library Systems – Digital Libraries

TEXT BOOKS

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books, 2011.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2010.

REFERENCES

1. C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Bruce Croft, Donald Metzler and Trevor Strohman, "Search Engines: Information Retrieval in Practice", First Edition, Addison Wesley, 2009.

213INT1303	Parallel and Distributed Computing	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To understand the need and fundamentals of parallel computing paradigms • To learn the nuances of parallel algorithm design • To understand the programming principles in parallel and distributed computing architectures • To learn few problems that are solved using parallel algorithms						
Course Outcome(s)							
CO1	Apply parallel and distributed computing architectures for any given problem						
CO2	Apply problem solving (analysis, design, and development) skills to distributed applications						
CO3	Develop applications by incorporating parallel and distributed computing architectures						
CO4	Develop applications by incorporating fault tolerance						
CO5	Convert a sequential algorithm to a parallel one						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3				3						3	2		
CO2	2	3	3											1	
CO3	1	3	3												2
CO4		3	3	3	1						2	3		3	
CO5			3	3	1						2	2	2		

Course Topic(s)

UNIT 1: INTRODUCTION TO PARALLEL COMPUTING

Scope of Parallel Computing – Parallel Programming Platforms – Implicit Parallelism – Limitations of Memory System Performance – Control Structure of Parallel Platforms – Communication Model of Parallel Platforms – Physical Organization of Parallel Platforms – Communication Costs in Parallel Machines – Impact of Process - Processor Mapping and Mapping Techniques.

UNIT 2: PARALLEL ALGORITHM DESIGN

Preliminaries – Decomposition Techniques – Characteristics of Tasks and Interactions – Mapping Techniques for Load Balancing – Methods for Containing Interaction Overheads – Parallel Algorithm Models – Basic Communication Operations – One-to-All Broadcast and All-to-One Reduction – All-to-All Broadcast and Reduction – All-Reduce and Prefix Sum Operations – Scatter and Gather – All-to-All Personalized Communication- Circular Shift – Improving the Speed of some Communication Operations

UNIT 3: PROGRAMMING USING MESSAGE PASSING AND SHARED ADDRESS SPACE

Principles of Message Passing Programming – Building Blocks – Send and Receive Operations – MPI – Message Passing Interface – Topologies and Embedding – Overlapping Communication with Computation – Collective Communication and Computation Operations – Groups and Communicators – POSIX thread API – OpenMP: a Standard for Directive based Parallel Programming – Applications of Parallel Programming - Matrix-Matrix Multiplication – Solving Systems of Equations – Sorting Networks - Bubble Sort Variations – Parallel Depth First Search

UNIT 4: DISTRIBUTED COMPUTING PARADIGM

Paradigms for Distributed applications – Basic algorithms in Message passing Systems – Leader Election in Rings – Mutual Exclusion in Shared Memory

UNIT 5: FAULT TOLERANT DESIGN

Synchronous Systems with Crash Failures – Byzantine Failures – Impossibility in Asynchronous Systems - Formal Model for Simulation – Broadcast and Multicast – Specification of a Broadcast Service – Implementing a Broadcast Service – Multicast in Groups – Distributed Shared Memory – Linearizable – Sequentially Consistent Shared Memory – Algorithms

TEXT BOOK

1. AnanthGrama, Anshul Gupta, George Karypis and Vipin Kumar, ―Introduction to Parallel Computing‖, Second Edition, Pearson Education, 2009.
2. HaggitAttiya and Jennifer Welch, ―Distributed Computing – Fundamentals, Simulations and Advanced Topics‖, Second Edition, Wiley, 2012.

REFERENCES

1. Norman Matloff, ―Parallel Computing for Data Science – With Examples in R, C++ and CUDA‖, Chapman and Hall/CRC, 2015.
2. Wan Fokkink, ―Distributed Algorithms: An Intuitive Approach‖, MIT Press, 2013.
3. M.L. Liu, ―Distributed Computing – Principles and Applications‖, First Edition, Pearson Education, 2011.

213INT3303	GRAPH THEORY	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Structures and Algorithms (212INT2303)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	This course comprehends the graphs as a modeling and analysis tool in computer science & Engineering. It introduces the structures such as graphs & trees and techniques of counting and combinations, which are needed in number theory based computing and network security studies in Computer Science.						
Course Outcome(s)							
CO1	Able to precise and accurate mathematical definitions of objects in graph theory.						
CO2	Apply mathematical definitions to identify and construct examples						
CO3	Able to Validate and critically assess a mathematical proof.						
CO4	Analyze the use of combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.						
CO5	Identify the reason from definitions to construct mathematical proofs.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3											3		
CO2								2						2	
CO3		3					1								2
CO4						3								3	
CO5		1		2		3							2		

Course Topic(s)

UNIT 1 INTRODUCTION

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

UNIT 2 TREES, CONNECTIVITY & PLANARITY

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets –Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometricgraphs – Planer graphs – Different representation of a planer graph.

UNIT 3 MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

UNIT 4 PERMUTATIONS & COMBINATIONS

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

UNIT 5 GENERATING FUNCTIONS

Generating functions - Partitions of integers - Exponential generating function – Summation operator - Recurrence relations - First order and second order – Non-homogeneous recurrence relations - Method of generating functions

TEXT BOOKS:

1. NarsinghDeo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003.
2. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Addison Wesley, 1994.

REFERENCES:

1. Clark J. & Holton D.A., A First Look at Graph Theory, Allied Publishers, 1995.
2. Mott J.L., Kandel A. & Baker T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India, 1996.
3. Liu C.L., Elements of Discrete Mathematics, McGraw Hill, 1985.
4. Rosen K.H., Discrete Mathematics And Its Applications, McGraw Hil, 2007

213INT1109	EDGE COMPUTING	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	This course comprehends the graphs as a modeling and analysis tool in computer science & Engineering. It introduces the structures such as graphs & trees and techniques of counting and combinations, which are needed in number theory based computing and network security studies in Computer Science.						
Course Outcome(s)							
CO1	Explore research, frameworks, applications in edge and fog computing.						
CO2	Review underlying technologies, limitations, and challenges along with future research direction and discuss generic conceptual framework for optimization problems in fog computing.						
CO3	Analyse the restrictions introduced by the General Data Protection Regulation (GDPR), and discuss how these legal constraints affect the design and operationof IoT applications in fog and cloud environments.						
CO4	Design and develop simulation scenarios for Edge and Fog Computing using network simulator.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3											2		
CO2								2						1	
CO3		3					1								2
CO4						3								3	
CO5													2		

Course Topic(s)

Edge and Fog Computing – Foundations
Internet of Things (IoT) and New Computing Paradigms . Addressing the challenges in Federating Edge Resources- Integrating IoT + Fog + Cloud Infrastructures: System Modelling and Research Challenges- Management and Orchestration of Network slices in 5G, Fog, Edge and Clouds . Optimization problems in Fog and Edge Computing

Middleware
Middleware for Fog and Edge Computing: Design Issues . A Lightweight Container Middleware for Edge Cloud Architectures - Data Management in Fog Computing
- Predictive analysis to develop to support Fog Application Deployment- Using Machine Learning (ML) for protecting the security and privacy of IoT Systems

Applications
Fog Computing Realization for Big Data Analytics. Exploiting Fog Computing in Health Monitoring.- Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking. Fog Computing Model for Evolving Smart Transportation Applications.

Application Testing and Issues
Testing Perspectives of Fog-Based IoT Applications. Legal Aspects of Operating IoT Applications in the Fog.

Model & Simulate Edge and Fog computing
Model Fog and Edge Computing Environments Using network simulator toolkit (such as iFogSim, Ns3, OMNeT++, NetSim etc..,) - Simulate Fog and Edge Computing Environments Using network simulator Toolkit (such as iFogSim, Ns3, OMNeT++, NetSim etc..,)

Books:
Satish Narayana Srirama, RajkumarBuyya,. (2019), , Fog and Edge Computing : Principles and Paradigms ,Wiley ,.

AbdulrahmanYarali,. (2018), , Cloud, Fog, and Edge: Technologies and Trends in Telecommunications Industry (Computer Science, Technology and Applications), Nova Science Pub Inc].

Mahmood, Zaigham,. (2018), , Fog Computing Concepts, Frameworks and Technologies,Springer.

Rahmani, A., Liljeberg, P., Preden, J.-S., Jantsch, A.,. (2018), , Fog Computing in the Internet of Things Intelligence at the Edge,Springer.

AI STREAM

213INT1110	BIO INFORMATICS	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Theory						
Objective(s)	• Exposed to the need for Bioinformatics technologies • Be familiar with the modeling techniques • Learn microarray analysis • Exposed to Pattern Matching and Visualization						
Course Outcome(s)							
CO1	Learn the structural bioinformatics						
CO2	Understand the concept of data warehousing and data mining in bioinformatics						
CO3	Examine different models in bio informatics						
CO4	Demonstrate the various patterns of DNA						
CO5	Learn to analyze image and data extraction in informatics database						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	2										2		
CO2	3	3			3							1		1	
CO3	1	3	2												2
CO4	1				2		3							3	
CO5	1	3	2		2							1	2		

Course Topic(s)

UNIT 1: INTRODUCTION

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.

UNIT 2: DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

UNIT 3: MODELING FOR BIOINFORMATICS

Hidden markov modeling for biological data analysis – Sequence identification –Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

UNIT 4: PATTERN MATCHING AND VISUALIZATION

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNIT 5: MICROARRAY ANALYSIS

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

TEXT BOOK

1. Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.

REFERENCES

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education,2003.
2. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005.

213INT1311	NEURAL NETWORKS AND FUZZY LOGIC	L	T	P	X	C	H
		2	1	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• Introduce students to the various neural network and fuzzy systems models. • Reveal different applications of these models to solve engineering and other problems. • Introduce the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control. • Discuss neural networks and fuzzy systems, architectures, algorithms and applications, including Back-propagation, BAM, Hopfield network, Competitive Learning, Fuzzy inference methods and expert systems						
Course Outcome(s)							
CO1	Identify different neural network architectures, their limitations and appropriate learning rules for each of the architectures						
CO2	Design and implement a neural network simulation (with two modes of operation: learning and processing) using a high-level language C++						
CO3	Demonstrate knowledge and understanding of fuzzy system as applied in engineering and science						
CO4	Learn the power and usefulness of artificial neural networks in several applications including speech synthesis, diagnostic problems, business and finance, robotic control, signal processing, computer vision and many other problems that fall under the category of pattern recognition						
CO5	Develop models for different applications using fuzzy system and MatLab						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3		3			2						2		
CO2		3	3											1	
CO3							3			3	3	1			2
CO4		2												3	
CO5			3	2									2		

Course Topic(s)

UNIT 1: INTRODUCTION TO NEURAL NETWORKS

Introduction - Humans and Computers - Organization of the Brain - Biological Neuron - Biological and Artificial Neuron Models - Characteristics of ANN - Models of ANNs -

McCulloch-Pitts Model - Feed forward & feedback networks - learning rules - Hebbian learning rule - perception learning rule - delta learning rule - Widrow-Hoff learning rule - correction learning rule - Winner –lake all learning rule - etc.

UNIT 2: FEED FORWARD NEURAL NETWORKS

Classification model - Features & Decision regions - training & classification using discrete perception - algorithm - single layer continuous perception networks for linearly separable classifications - linearly non- separable pattern classification - Delta learning rule for multi-perception layer - Generalized delta learning rule -Back-propagation training - learning factors - Examples.

UNIT 3: ASSOCIATIVE MEMORIES

Paradigms of Associative Memory - Pattern Mathematics - Hebbian Learning - General Concepts of Associative Memory - Bidirectional Associative Memory (BAM) Architecture - BAM Training Algorithms - Storage and Recall Algorithm - BAM Energy Function - Hopfield networks - Basic Concepts - Training & Examples - SOM-UN supervised learning of clusters - winner-take-all learning - recall mode, Initialization of weights - seperability limitations del - Historical Developments - Potential Applications of ANN.

UNIT 4: CLASSICAL SETS

Introduction to classical sets – properties - Operations and relations -Fuzzy sets –Membership – Uncertainty – Operations – properties - fuzzy relations – cardinalities - membership functions - Overview of Classical Sets - Membership Function - a-cuts - Properties of a-cuts – Decomposition – Theorems - Extension Principle

UNIT 5: UNCERTAINTY BASED INFORMATION

Information & Uncertainty - Non specificity of Fuzzy & Crisp sets - Fuzziness of Fuzzy Sets – Fuzzification - Membership value assignment - development of rule base and decision making system - Defuzzification to crisp sets - Defuzzification methods - Neural network applications - Process identification – control - fault diagnosis - Fuzzy logic applications - Fuzzy logic control and Fuzzy classification.

TEXT BOOKS

1. S. Rajasekharan and G. A. Vijayalakshmipai, “Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications”, PHI Publication, 2011.
2. John Yen and Reza Langan, “Fuzzy Logic: Intelligence, Control and Information”,Pearson Education, 2011.

REFERENCES

1. Simon Haykin, “Neural Networks- A comprehensive foundation”, Pearson Education, 2005.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa “Introduction to Neural Networks using MATLAB 6.0”, TMH, 2006.
3. James A Freeman and Davis Skapura, Neural Networks Pearson Education, 2002.

213INT3304	MACHINE LEARNING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Data Structures and Algorithms (212INT2303)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To introduce students to the basic concepts and techniques of Machine Learning. • To have a thorough understanding of the Supervised and Unsupervised learning techniques • To study the various probability based learning techniques • To understand graphical models of machine learning algorithms						
Course Outcome(s)							
CO1	Distinguish between, supervised, unsupervised and semi-supervised learning						
CO2	Choose the appropriate machine learning strategy for any given problem						
CO3	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem						
CO4	Design systems that use the appropriate graph models of machine learning						
CO5	Modify existing machine learning algorithms to improve classification efficiency						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		1	3										2		
CO2	1		3	2		3								1	
CO3			3	2		2		3							2
CO4			2			2						3		3	
CO5										3		3	2		

Course Topic(s)

UNIT 1 : INTRODUCTION

Learning – Types of Machine Learning –Supervised Learning – The Brain and the Neuron– Design a Learning System –Perspectives and Issues in Machine Learning–Concept Learning Task –Concept Learning as Search –Finding a Maximally Specific Hypothesis –Version Spaces and the Candidate Elimination Algorithm –Linear Discriminants –Perceptron –Linear Separability –Linear Regression

UNIT 2: LINEAR MODELS

Multi-layer Perceptron – Going Forwards –Going Backwards: Back Propagation Error –Multi-layer Perceptron in Practice –Examples of using the MLP –Overview –Deriving Back-

Propagation –Radial Basis Functions and Splines –Concepts –RBF Network –Curse ofDimensionality– Interpolations and Basis Functions –Support Vector Machines

UNIT 3 : TREE AND PROBABILISTIC MODELS

Learning with Trees –Decision Trees –Constructing Decision Trees –Classification and Regression Trees –Ensemble Learning –Boosting –Bagging –Different ways to Combine Classifiers –Probability and Learning –Data into Probabilities –Basic Statistics –Gaussian Mixture Models –Nearest Neighbor Methods –Unsupervised Learning –K means Algorithms – Vector Quantization –Self Organizing Feature Map

UNIT 4: DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS

Dimensionality Reduction –Linear Discriminant Analysis –Principal Component Analysis –Factor Analysis –Independent Component Analysis –Locally Linear Embedding –Isomap –LeastSquares Optimization –Evolutionary Learning –Genetic algorithms –Genetic Offspring: -GeneticOperators –Using Genetic Algorithms –Reinforcement Learning –Overview –Getting Lost Example – Markov Decision Process

UNIT 5: GRAPHICAL MODELS

Markov Chain Monte Carlo Methods–Sampling –Proposal Distribution –Markov Chain Monte Carlo –Graphical Models –Bayesian Networks –Markov Random Fields –Hidden Markov Models –Tracking Methods

TEXTBOOKS:

1. Stephen Marsland, ―Machine Learning –An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.

REFERENCES:

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2. Jason Bell, ―Machine learning –Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014

213INT1312	SOFT COMPUTING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To give students knowledge of soft computing theories fundamentals, • To learn the fundamentals of non-traditional technologies and approaches to solving hard real-world problems. • To learn and apply artificial neural networks, fuzzy sets and fuzzylogic, and genetic algorithms in problem solving and use of heuristics based on human experience						
Course Outcome(s)							
CO1	Learn the importance of tolerance of imprecision and uncertainty for design of robust and low- cost intelligent machines.						
CO2	Acquire soft computing fundamentals and design systems for solving various real-world problems.						
CO3	Integrate the knowledge of neural networks, fuzzy logic, genetic algorithms, probabilistic reasoning, rough sets, chaos, hybrid approaches						
CO4	Learn about fuzzy sets, fuzzy logic , neural networks and form appropriate rules for inference systems						
CO5	Learn about genetic algorithms and other random search procedures for global optimum in self-learning situations						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				3									2		
CO2				3		3								1	
CO3				3		2		3	2						2
CO4				2		2			2			3		3	
CO5										3		3	2		

Course Topic(s)

UNIT 1 : NEURAL NETWORKS -I

(Introduction and Architecture) Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning Techniques; Perception and Convergence Rule, Auto-Associative and Hetro-Associative Memory.

UNIT 2 : NEURAL NETWORKS -II

(Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer

Artificial Neural Network, Multilayer Perception Model; Back Propagation Learning Methods, Effect of Learning Rule Co-Efficient ;Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications.

UNIT 3: FUZZY LOGIC -I

(Introduction) Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion.

UNIT 4 : FUZZY LOGIC –II

(Fuzzy Membership, Rules) Membership Functions, Interference in Fuzzy Logic, Fuzzy If -Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Industrial Applications

UNIT 5: GENETIC ALGORITHM

Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications

TEXTBOOKS:

1.S. Rajasekaran and G.A. VijayalakshmiPai, ―Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications‖, Prentice Hall of India, 2003. 2.N.P.Padhy,‖Artificial Intelligence and Intelligent Systems‖, Oxford University Press, 2005.

3.J.S.R. Jang, C.T. Sun and E. Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Pearson Education, 2004.

REFERENCES:

1. Siman Haykin, ―Neural Networks ‖, Prentice Hall of India, 1999

2. Timothy J. Ross, ―Fuzzy Logic with Engineering Applications‖, Third Edition, Wiley India, 2010

3. S.Y.Kung, ―Digital Neural Network‖, Prentice Hall International, 1993.

4. Aliev.R.A and Aliev,R.R, ― Soft Computing and its Application‖, World Scientific Publishing Company, 2001

213INT2305	SPEECH AND LANGUAGE PROCESSING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn the fundamentals of natural language processing • To appreciate the use of CFG and PCFG in NLP • To understand the role of semantics and pragmatics						
Course Outcome(s)							
CO1	To tag a given text with basic Language features						
CO2	To design an innovative application using NLP components						
CO3	To implement a rule based system to tackle morphology/syntax of a language						
CO4	To design a tag set to be used for statistical processing for real-time applications						
CO5	To compare and contrast use of different statistical approaches for different types of NLP applications						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3												2		
CO2	3					3								1	
CO3	3					2		3	2						2
CO4	2					2			2			3		3	
CO5										3		3	2		

Course Topic(s)

UNIT 1 : INTRODUCTION

Words-Regular Expressions and Automata -Words and Transducers -N-grams -Part-of-Speech –Tagging -Hidden Markov and Maximum Entropy Models.

UNIT 2: SPEECH

Speech–Phonetics -Speech Synthesis -Automatic Speech Recognition -Speech Recognition: -Advanced Topics -Computational Phonology

UNIT 3: SYNTAX

Formal Grammars of English -Syntactic Parsing -Statistical Parsing -Features and Unification -Language and Complexity.

UNIT 4: SEMANTICS AND PRAGMATICS

The Representation of Meaning -Computational Semantics -Lexical Semantics -Computational Lexical Semantics -Computational Discourse

UNIT 5: APPLICATIONS

Information Extraction -Question Answering and Summarization -Dialogue and Conversational Agents -Machine Translation

TEXTBOOKS:

1. Daniel Jurafsky,―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech‖, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python‖, First Edition, O'Reilly Media, 2009.

REFERENCES:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook‖, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java‖, O'Reilly Media,2015.
3. Nitin IndurkhyaandFred J. Damerau, ―Handbook of Natural Language Processing‖, Second Edition, Chapman and Hall/CRC Press, 2010.

213INT1313	DEEP LEARNING	L	T	P	X	C	H
		3	0	2	0	4	5
Prerequisite	Nil						
Course Category	Professional Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• To present the mathematical, statistical and computational challenges of building neural networks • To study the concepts of deep learning • To introduce dimensionality reduction techniques • To enable the students to know deep learning techniques to support real-time applications • To examine the case studies of deep learning techniques						
Course Outcome(s)							
CO1	Understand basics of deep learning						
CO2	Implement various deep learning models						
CO3	Realign high dimensional data using reduction techniques						
CO4	Analyze optimization and generalization in deep learning						
CO5	Explore the deep learning applications						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					3								2		
CO2	3				3		3							1	
CO3			1		3										2
CO4	2				2						2			3	
CO5													2		

Course Topic(s)

UNIT 1: INTRODUCTION

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT 2: DEEP NETWORKS

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT 3: DIMENTIONALITY REDUCTION

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT 4: OPTIMIZATION AND GENERALIZATION

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization-Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT 5: CASE STUDY AND APPLICATIONS

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

REFERENCES:

1. CosmaRohillaShalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

213INT1101	Augmented Reality and Virtual Reality	L	T	P	X	C	H
		3	0	0	0	3	3
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Theory						
Objective(s)	Introduction to virtual reality, output/input devices, virtual reality APIs, 3D interaction techniques, modeling and simulation, experimental design and user studies, effects of system fidelity, augmented reality, real-world applications of virtual reality						
Course Outcome(s)							
CO1	Design, create, and integrate audio, visual, and interactive elements into a comprehensive immersive experience.						
CO2	Develop content for successful delivery across multiple platforms, including PC, mobile devices and head-mounted displays.						
CO3	Evaluate current trends of AR and VR media delivery to propose options to potential clients, and discuss the benefits, challenges and misconceptions involved with working in AR and VR.						
CO4	Evaluate various interaction schemes common to AR/VR experiences.						
CO5	Use immersive effects of visual and audio assets to AR/VR experiences and evaluate implementation methods.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2				3							2		
CO2	3				3		3							1	
CO3			1		3				3						2
CO4	2				2						2			3	
CO5													2		

Course Topic(s)

UNIT 1: INTRODUCTION

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT 2: DEEP NETWORKS

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT 3: DIMENTIONALITY REDUCTION

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UNIT 4: OPTIMIZATION AND GENERALIZATION

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UNIT 5: CASE STUDY AND APPLICATIONS

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REFERENCES:

1. CosmaRohillaShalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

OPEN ELECTIVE

214INT1301	WEB PROGRAMMING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	**Nil**						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To learn the theoretical and practical concepts of web programming. • To introduce the programming languages for developing simple web applications. • To make students to understand about the architecture of web server and deployment of web site • To teach methodologies useful for the implementation of dynamic web applications • To efficiently design and implement web applications using server side programming languages						
Course Outcome(s)							
CO1	Understand the programming concepts of HTML, DHTML, CSS, JavaScript, XML and other Web technologies						
CO2	Understand Java programming concepts and utilize Java Graphical User Interface program writing.						
CO3	Build Java Application for distributed environment. Design and Develop multi-tier applications.						
CO4	Utilize professional level platforms (ASP, JSP, Servlets) to produce software systems/websites that meet specified user needs and constraints.						
CO5	Understand database basics related to develop dynamic web applications and Apply XML for designing web pages.						

Mapping of COs with Pos														
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2		2	2	3								1		1	
CO3		2	2			3						1			2
CO4		2	2				3					1		3	
CO5		2	2								3	1	2		

Course Topic(s)

UNIT 1: INTRODUCTION

World Wide Web – History of the World Wide Web, World Wide Web Consortium – HTML – Dynamic HTML – Object model and collections, Event model, Filters and Transitions.

UNIT 2: JAVA SCRIPT

Introduction – Simple program, Memory concepts, Arithmetic, Decision making - Equality and Relational operators – Control statements – Control structures, Operators – Functions – Programmer defined functions, JavaScript global functions, Recursion – Arrays – References and Reference parameters, Passing arrays to functions, Multidimensional arrays – Objects – Object types, Cookies.

UNIT 3: XML

Introduction, Structuring data, XML namespaces, Document Type Definitions (DTDs) and Schemas, Document type definitions, W3C XML schema documents, XML vocabularies, Document Object Model (DOM), DOM methods, Simple API for XML (SAX), Extensible Style sheet Language (XSL), Simple Object Access Protocol (SOAP).

UNIT 4: PERL, CGI AND PHP

Introduction, String processing and Regular expressions, Viewing Client/Server environment variables, Form processing and Business logic, Verifying a username and password, Connecting to a database, Cookies, Operator precedence chart.

UNIT 5: JAVA PROGRAMMING

Classes – Constructors, Garbage collection - Overloading methods – Overriding methods - Exception handling - Multithreading – Creating a thread, Synchronization, Inter thread communication - Streams – Byte streams, Character streams.

TEXT BOOKS:

1. 1. Harvey Deitel, Abbey Deitel, “Internet and World Wide Web: How To Program” 5th Edition.
2. Herbert Schildt, “Java – The Complete Reference, 7th Edition”. Tata McGraw- Hill.

REFERENCES:

1. John Pollock, “Javascript – A Beginners Guide”, 3rd Edition –- Tata McGraw-Hill.
2. Keyur Shah, “Gateway to Java Programmer Sun Certification”, Tata McGraw Hill, 2002.

214INT2301	BIG DATA ANALYTICS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• Prepare the students to understand and practice Big Data Analytics using Hadoop Ecosystem and prepare them for a Career in Analytics as a Hadoop Developer, Hadoop Administrator, Data Scientist.						
Course Outcome(s)							
CO1	Understand the key issues on big data, characteristics, data sources and the associated applications in intelligent business and scientific computing.						
CO2	Acquire fundamental enabling techniques and scalable algorithms in big data analytics.						
CO3	Interpret business models and scientific computing paradigms, and apply software tools for Big data analytics.						
CO4	Achieve adequate perspectives of big data analytics in marketing, financial services, health services, social networking, astrophysics exploration, and environmental sensor applications, etc.						
CO5	Select visualization techniques and tools to analyze big data and create statistical models and understand how to handle large amounts of data.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2		2	2	3								1		1	
CO3		2	2			3						1			2
CO4		2	2				3					1		3	
CO5		2	2								3	1	2		

Course Topic(s)

UNIT 1: INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT 2: MINING DATA STREAMS

Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Realtime

Analytics Platform(RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT 3: HADOOP

History of Hadoop- The Hadoop Distributed File System –Components of Hadoop -Analyzing The Data with Hadoop-Scaling Out-Hadoop Streaming-Design of HDFS-Java interfaces toHDFS-Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of aMap Reduce Job run-Failures-Job Scheduling-Shuffle and Sort–Task execution-Map ReduceTypes and Formats

UNIT 4: HADOOP ENVIRONMENT

Setting up a Hadoop Cluster -Cluster specification -Cluster Setup and Installation -HadoopConfiguration-Security in Hadoop -Administering Hadoop –HDFS -Monitoring-Maintenance-Hadoop benchmarks-Hadoop in the cloud

UNIT 5: FRAMEWORKS

Applications on Big Data Using Pig and Hive –Data processing operators in Pig –Hive services –HiveQL –Querying Data in Hive -fundamentals of HBase and ZooKeeper -IBM InfoSphere-. Visualizations -Visual data analysis techniques, interaction techniques.

TEXT BOOKS:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

REFERENCES:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics", John Wiley & sons, 2012.
2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
Pete Warden, Big Data Glossary, O'Reilly, 2011.

214INT2302	INFORMATION THEORY & CODING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To introduce to the students the concept of information and entropy of Information. • To know the concept of compression of information, error control of Information, and securing information through cryptography. • Describe the mathematical foundation of compression, error control and security of information.						
Course Outcome(s)							
CO1	Understand the basic information and entropy.						
CO2	Analyze source coding compression, decoding and error control methods as applied in communication system.						
CO3	Understand different types coding techniques.						
CO4	Understand the basic number theory of coding techniques.						
CO5	Analysis the various algorithms techniques.						

Mapping of COs with Pos														
COs	PO's											PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3					3					3	2		
CO2	2	3	1											1	
CO3	3	3	1			1	3	1				1			2
CO4		3	1				2				3	1		3	
CO5		3	1				2				3	1	2		

Course Topic(s)

UNIT 1: INFORMATION THEORY & SOURCE CODING

Introduction to Information Theory- Entropy & Types of Entropy Source Coding, Prefix Coding, Channel Capacity

UNIT 2: COMPRESSION ALGORITHMS

Optimal Compression- Compression Algorithms, Huffman Coding, Adaptive Huffman Compression, Dictionary Based Compression, Speech Compression, Sliding Window Compression, LZW,RLE, Lossy& Lossless Compression Schemes, Image Compression – GIF,JPEG

UNIT 3: ERROR CONTROL CODING TECHNIQUES

Types of Codes - Error Checking & Correcting Codes, Linear Block Codes, Cyclic Codes, BCH

Codes, Convolution Codes

UNIT 4: BASIC NUMBER THEORY

Modular Arithmetic, Solving ax+by=d, Congruence's, Chinese Remainder Theorem Modular Exponentiation, Fermat's Little and Euler Theorem, Prime Number Generation, Random Number Generation, Primitive Roots, Legendre and Jacobi Symbols, Discrete Probability, Discrete Logarithms

UNIT 5: CRYPTOGRAPHIC TECHNIQUES

Security Goals, Threats and Attack on Information-Classic Cryptography-Symmetric Key Cryptography – Stream Ciphers, Block Cipher, Stream Cipher, DES, Triple DES,AES-Public and Private Key Cryptography – RSA, Diffie-Hellman-Hash Function – MD5,SHA-1,Digital Signature

TEXTBOOKS

1. Ranjan Bose, "Information Theory, Coding and Cryptography", Tata McGrawHill , Second Edition.2012

2. R Avudaiammal, "Information Coding Techniques", Tata McGrawHill , Second Edition.2009

REFERENCES

1.Mark Nelson, "Data Compression Book", BPB Publication 2nd edition 2002.

2.Watkinson J, "Compression in Video and Audio", Focal Press, London, 2005.

214INT1302	INTRODUCTION TO INFORMATION SECURITY	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	It covers Information Security, Vulnerabilities & threats, attacks, Risk Analysis, logical design and physical design						
Course Outcome(s)							
CO1	Understand the importance of information security and models to develop secure information system.						
CO2	Learn about various kinds of issues, threats, attacks involved while securing information						
CO3	Analyze the risks involved in information security						
CO4	Design and develop an information security system						
CO5	Learn the various technologies, tools and techniques used to ensure security.						

Mapping of COs with Pos														
COs	PO's											PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3									1	2		
CO2		3		3			3					1		1	
CO3		3		3		3	3								2
CO4			3									1		3	
CO5		3	2			3						1	2		

Course Topic(s)

UNIT 1: INTRODUCTION

History, Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT 2: SECURITY INVESTIGATION

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

UNIT 3: SECURITY ANALYSIS

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk

UNIT 4: LOGICAL DESIGN

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT 5: PHYSICAL DESIGN

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control

Devices, Physical Security, Security and Personnel

TEXT BOOK

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", 4th Edition,Vikas Publishing House, New Delhi, 2011.

REFERENCES

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", 6th edition vol-5, CRC Press LLC, 2011.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed 6th edition –Network security secrets and solutions", Tata McGraw-Hill, 2009.
3. Matt Bishop, "Computer Security Art and Science", Addison-Wesley Professional, 2003.

214INT2303	CYBER FORENSICS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To understand the fundamentals of Computer Forensics and computing Investigations. • To recognize the legal underpinnings and critical laws affecting forensics. • To apply the tools and methods to uncover hidden information in digital systems. • To learn about current licensing and certification requirements to build the career in digital forensic.						
Course Outcome(s)							
CO1	Understand of the role of computer forensics						
CO2	Identify some of the current techniques and tools						
CO3	Describe and identify basic principles of good professional practice for a forensic computing practitioner						
CO4	Demonstrate an understanding of issues related to privacy and determine how to address them technically and ethically.						
CO5	Apply some forensic tools in different situations.						

Mapping of COs with Pos														
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				1			1	2		
CO2		2			3				3					1	
CO3	1	3		3			2				3				2
CO4				2	3			3				2		3	
CO5		3				3					3		2		

Course Topic(s)

UNIT 1: NTRODUCTION

The Scope of Computer Forensics - Windows Operating and File Systems –Handling Computer Hardware – Anatomy of Digital Investigation.

UNIT 2: INVESTIGATIVE SMART PRACTICES

Forensics Investigative Smart Practices – Time and Forensics – Incident closure

UNIT 3: LAWS AND PRIVACY CONCERNS

Laws Affecting Forensic Investigations – Search Warrants and Subpoenas – Legislated Privacy Concerns – The admissibility of Evidence – First Response and Digital Investigator

UNIT 4: DATA ACQUISITION AND REPORT WRITING

Data Acquisition – Finding Lost Files – Document Analysis – Case Management and Report Writing – Building a Forensics Workstation

UNIT 5: TOOLS AND CASE STUDIES

Tools of the Digital Investigator - Licensing and Certification – Case Studies: E-mail Forensics – Web Forensics – Searching the Network – Excavating a Cloud – Mobile device Forensics.

TEXTBOOKS:

1. Michael Graves, "Digital Archaeology: The Art and Science of Digital Forensics", Addison-Wesley Professional, 2014.
2. Darren R. Hayes, "Practical Guide to Computer Forensics Investigation", Pearson, 2015.
3. Albert J. Marcella and Frederic Guillossou, "Cyber Forensics: From Data to Digital Evidence " Wiley, 2015.

REFERENCE:

1. Bill Nelson, Amelia Phillips and Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Cengage Learning, 2013**.**

214INT1303	ESSENTIALS OF INFORMATION TECHNOLOGY	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	To know the concept of Internet, Networks and its working principles and understand the various applications related to Information Technology.						
Course Outcome(s)							
CO1	Understand the concept of website design and types of server.						
CO2	Know about scripting languages.						
CO3	Identify the concepts of Internet, Networks and its working principles.						
CO4	Understand the concept of mobile communication.						
CO5	Understand various applications related to Information Technology.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				1			1	2		
CO2		2			3				3					1	
CO3	1	3		3			2				3				2
CO4				2	3			3				2		3	
CO5		3				3					3		2		

Course Topic(s)

UNIT 1: WEB ESSENTIALS

Creating a Website - Working principle of a Website - Browser fundamentals - Authoring tools - Types of servers: Application Server - Web Server - Database Server

UNIT 2: SCRIPTING ESSENTIALS

Need for Scripting languages - Types of scripting languages - Client side scripting - Server side scripting - PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and MySQL - PHP and HTML - Cookies - Simple PHP scripts

UNIT 3: **NETWORKING ESSENTIALS**

Fundamental computer network concepts - Types of computer networks - - Network layers - TCP/IP model - Wireless Local Area Network - Ethernet - WiFi - Network Routing - Switching - Network components.

UNIT 4: MOBILE COMMUNICATION ESSENTIALS

Cell phone working fundamentals - Cell phone frequencies & channels - Digital cell phone

components - Generations of cellular networks - Cell phone network technologies / architecture - Voice calls & SMS.

UNIT 5: APPLICATION ESSENTIALS

Creation of simple interactive applications - Simple database applications - Multimedia applications - Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications.

TEXT BOOKS:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014.
2. James F. Kurose, “Computer Networking: A Top-Down Approach”, Sixth Edition, Pearson, 2012.

REFERENCES:

1. GottapuSasibhushana Rao, "Mobile Cellular Communication", Pearson, 2012. 2. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, “Introduction to Information Systems”, Fifth Edition, Wiley Publication, 2014. 3. it-ebooks.org

214INT2304	INTERNET AND JAVA	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	To learn the basics of Internetworking, Routing, World Wide Web, Java Programming with simple case studies.						
Course Outcome(s)							
CO1	Understand the concept of Internetworking with TCP/IP						
CO2	Learn routing for high speed multimedia traffic						
CO3	Learn the fundamentals in WWW, HTML and XML.						
CO4	Understand Java for Networking application						
CO5	Understand the basic concepts in E-com, Network operating system and Web design.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2		2	2	3								1		2	
CO3		2	2			3						1			2
CO4		2	2				3					1		3	
CO5		2	2								3	1	2		

Course Topic(s)

UNIT 1: INTERNETWORKING WITH TCP / IP

Review of network technologies, Internet addressing, Address resolution protocols (ARP / RARP), Routing IP datagrams, Reliable stream transport service (TCP) TCP / IP over ATM networks, Internet applications - E-mail, Telnet, FTP, NFS, Internet traffic management.

UNIT 2: INTERNET ROUTING

Concepts of graph theory, Routing protocols, Distance vector protocols (RIP), Link state protocol (OSPP), Path vector protocols (BGP and IDRP), Routing for high speed multimedia traffic, Multicasting, Resource reservation (RSVP), IP switching.

UNIT 3: WORLD WIDE WEB

HTTP protocol, Web browsers netscape, Internet explorer, Web site and Web page design, HTML, Dynamic HTML, CGI, Java script.

UNIT 4: INTRODUCTION TO JAVA

The java programming environment, Fundamental Programming structures, Objects and Classes, Inheritance, Event handling, Exceptions and Debugging, Multithreading , RMI.

UNIT 5: JAVA PROGRAMMING

Networking with Java, Swing: Applets and Applications, Menu's & Tool Bars, Java and XML – Creating packages, Interfaces, JAR files & Annotations, Javabeans, JDBC.

TEXTBOOKS

1. Douglas E.Comer, "Internetworking with TCP/IP", Vol. I: 5th edition, Pearson Education, 2007 (Unit – I &II)
2. Robert W.Sebesta, "Programming the worldwide web", 3/e, Pearson Education, 2007.
3. Steven Holzner et. al, "Java 2 Programming" , Black Book, Dreamtech Press, 2006.

REFERENCES

1. Cay S.Hortsmann, Gary Cornwell, "Core Java 2", Vol I, Pearson Education, 7/e, 2005.
2. W. Richard Stevens, " TCP/IP Illustrated, The Protocol" , Vol I , Pearson Education, 1st Edition, 2006.
3. Behrouz A. Farouzon , "TCP/IP Protocol Suite, 3rd edition , Tata McGraw Hill, 2007

214INT1304	R PROGRAMMING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	The student will be able to learn • Understand what R is and what it can be used for • Why would you choose R over another tool • Troubleshoot software installs (keep your fingers crossed) • Gain familiarity with using R from within the RStudio IDE • Get to know the basic syntax of R functions • Be able to install and load a package into your R library						
Course Outcome(s)							
CO1	Familiarize themselves with R and the RStudio IDE						
CO2	Understand and use the various forms of data with R						
CO3	Access online resources for R and import new function packages into the R workspace						
CO4	Import, review, manipulate and summarize data-sets in R						
CO5	Get insight into the capabilities of the language as a productivity tool for data manipulation and statistical analyses.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1										2		
CO2	3	3	2											1	
CO3	3				2										2
CO4			2		2	2	2							3	
CO5								1			1		2		

Course Topic(s)

UNIT I: INTRODUCTION

Getting R, R Version, 32-bit versus 64-bit, The R Environment, Command Line Interface, RStudio, Revolution Analytics RPE, R Packages: Installing Packages, Loading Packages, Building a Package R Basics: Basic Math, Variables, Data Types, Vectors, Calling Functions, Function Documentation, Missing Data Advanced Data Structures: data frames, Lists, Matrices, Arrays

UNIT II: R DATA

Reading Data into R: Reading CSVs, Excel Data, Reading from Databases, Data from Other Statistical Tools, R Binary Files, Data Included with R, Extract Data from Web Sites Statistical

Graphics: Base Graphics, ggplot2

UNIT III: R FUNCTIONS & STATEMENTS

Writing R Functions: Hello, World!, Function Arguments, Return Values, do.call Control Statements: if and else, switch, ifelse, Compound Tests Loops: for Loops, while Loops, Controlling Loops

UNIT IV: DATA MANIPULATION

Group Manipulation: Apply Family, aggregate, plyr, data.table Data Reshaping: cbind and rbind, Joins, reshape2 Manipulating Strings: paste, sprint, Extracting Text, Regular

UNIT V: R STATISTICS & LINEAR MODELING

Probability Distributions: Normal Distribution, Binomial Distribution, Poisson Basic Statistics: Summary Statistics, Correlation and Covariance, T-Tests 200, ANOVA Linear Models: Simple Linear Regression, Multiple Regression Generalized Linear Models: Logistic Regression, Poisson Model Diagnostics: Residuals, Comparing Models, Cross-Validation, Bootstrap, Stepwise Variable Selection

TEXT BOOK(S):

1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Pearson Edu. Inc.,2nd Edition, 2017

REFERENCES:

1. Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis-With Exercises, Solutions and Applications in R, Springer, 2016
2. Pierre Lafaye de Micheaux, RémyDrouilhet, Benoit Liquet, The R Software-Fundamentals of Programming and Statistical Analysis, Springer 2013
3. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, A Beginner's Guide to R (Use R) Springer 2009

214INT1305	PROGRAMMING WITH C++ AND JAVA	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To get a clear understanding of object-oriented concepts. • To understand object oriented programming through C++. • To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance. • To make the student to become aware of the Internet Principles, Basic Web Concepts, Mark up& Scripting Languages. • To equip the student with the techniques of CGI, Socket and Server side programming for online communication and computing						
Course Outcome(s)							
CO1	Understand the object-oriented concepts. To understand object oriented programming through C++.						
CO2	Understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code.						
CO3	Understand Java programming concepts and utilize Java Graphical User Interface in program writing.						
CO4	Understand database basics related to develop dynamic web applications and Apply XML for designing web pages.						
CO5	Utilize professional level platforms (ASP, JSP, Servlets) to produce software systems/websites that meet specified user needs and constraints.Evaluate the software system/websites produced for usability, efficiency and accuracy.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2		2	2	3								1		1	
CO3		2	2			3						1			2
CO4		2	2				3					1		3	
CO5		2	2								3	1	2		

Course Topic(s)
UNIT 1: INTRODUCTION TO OOP, CLASS & OBJECTS Object Oriented Programming Paradigm- Basic Concepts of OOP- Benefits of OOP- Object

Oriented Languages- Features of OOP- How OOP Differ from Procedure Oriented Programming-applications of OOP-a Simple C++ Program- structure of C++ Program-basicData Types in C++- Operators in C++ - Scope Resolution Operator- Member Dereferencing Operators- memory 31 SE-Engg&Tech-SRM-2013 management operators- Introduction of Classes-Inline member functions-Objects - Arrays of Objects- Objects as Function Arguments- Static data member and static member functions – Constructors- Parameterized Constructors- Default Argument constructors - Copy Constructors- Destructors – Friend functions.

UNIT 2: POLYMORPHISM, TEMPLATES & EXCEPTION HANDLING

Introduction to Operator overloading- Rules for Operator overloading- overloading of binary and unary operators-Introduction to inheritance–Types of inheritance- Abstract Classes- new Operator and delete Operator- Pointers to Objects- this Pointer- Virtual Functions- Pure Virtual Functions-Introduction to Class Templates- Function Templates-Member Function Templates- Basics of Exception Handling- Types of exceptions- Exception Handling Mechanism- Throwing and Catching Mechanism- Rethrowing an Exception- Specifying Exceptions.

UNIT 3: JAVA PROGRAMMING

An overview of Java – Data Types – Variables and Arrays – Operators – Control Statements – Classes – Objects – Methods – Inheritance – Packages – Abstract classes – Interfaces and Inner classes – Exception handling – Introduction to Threads – Multithreading – String handling – Streams and I/O – Applets.

UNIT 4: WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0

Web 2.0: Basics-RIA Rich Internet Applications – Collaborations tools – Understanding websites and web servers: Understanding Internet – Difference between websites and web server- Internet technologies Overview –Understanding the difference between internet and intranet; HTML and CSS: HTML 5.0 , XHTML, CSS 3.

UNIT 5: CLIENT SIDE AND SERVER SIDE PROGRAMMING

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript. Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat WebServer;-DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code.

TEXTBOOKS:

1. Deitel and Deitel and Nieto, “Internet and World Wide Web – How to Program”, Prentice Hall, 5thEdition,2011.

2. Herbert Schildt, “Java-The Complete Reference”, Eighth Edition, Mc Graw Hill Professional, 2011.

REFERENCES:

1. StephenWynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition,1999.

2. Chris Bates, “Web Programming – Building Intranet Applications”, 3rd Edition, Wiley Publications, 2009.

3. Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”, Pearson Education, 2011.

214INT2305	NETWORK PROTOCOLS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	It understands the networking concepts and Multiple protocols types.						
Course Outcome(s)							
CO1	Understand the existing network architecture models and analyzes their performance.						
CO2	Understand the multiple layers of the protocol.						
CO3	Understand the high speed network protocols and design issues.						
CO4	Learn Network Security Technologies and Protocols.						
CO5	To study various protocols in wireless LAN, MAN.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				1			1	2		
CO2		2			3				3					1	
CO3	1	3		3			2				3				2
CO4				2	3			3				2		3	
CO5		3				3					3		2		

Course Topic(s)

UNIT 1: FUNDAMENTALS OF NETWORKING STANDARDS AND PROTOCOLS

Network Communication Architecture and Protocols - OSI Network Architecture seven Layers Model - Definition and Overview of TCP/IP Protocols -TCP/IP Four Layers Architecture Model - Other Network Architecture Models: IBM SNA.

UNIT 2: **ROUTED AND ROUTING PROTOCOLS**

Application Layer Protocols-Presentation Layer Protocols- Session Layer Protocols - Transport Layer Protocols - Network Layer Protocols - Data Link Layer Protocols - Routing Protocols - Multicasting Protocols - MPLS.

UNIT 3: SDN AND NETWORK MANAGEMENT PROTOCOLS

Overview of ISDN − Channels − User access – Protocols Network management requirements − Network monitoring − Network control − SNMP V1, V2 and V3 − Concepts, MIBs − Implementation issues-RMON.

UNIT 4: SECURITY AND TELEPHONY PROTOCOLS

Network Security Technologies and Protocols - AAA Protocols - Tunneling Protocols - Security Protocols- Private key encryption − Data encryption system, public key encryption − RSA −

Elliptic curve cryptography − Authentication mechanisms− Web security -Secured Routing Protocols - IP telephony -Voice over IP and VOIP Protocols –Signaling Protocols- Media/CODEC.

UNIT 5: NETWORK ENVIRONMENTS AND PROTOCOLS

Wide Area Network and WAN Protocols - Frame relay - ATM - Broadband Access Protocols - PPP Protocols - Local Area Network and LAN Protocols - Ethernet Protocols - Virtual LAN Protocols - Wireless LAN Protocols - Metropolitan Area Network and MAN Protocol - Storage Area Network and SAN Protocols.

TEXT BOOK

1. Javvin, "Network Protocols" ,Javvin Technologies Inc , second edition, 2005
2. William Stallings, "Cryptography and Network Security", PHI, 2000.
3. Mani Subramanian, "Network Management−Principles and Practices", Addison Wesley, 2000.

REFERENCES

1. William Stallings, "SNMP, SNMPV2, SNMPV3 and RMON1 and 2", 3rd Edition, Addison Wesley, 1999.
2. William Stallings, "Data and Computer Communications" 5th Edition, PHI, 1997.

214INT3301	HIGH SPEED NETWORKS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	To highlight the features of different technologies involved in High Speed Networking and their performance.						
Course Outcome(s)							
CO1	Students will get an introduction about ATM and Frame relay.						
CO2	Enable to know techniques involved to support real-time traffic and congestion control.						
CO3	Understand the concept of traffic management.						
CO4	Understand different services in network.						
CO5	Students will be provided with different levels of quality of service (Q.S) to different applications.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			3				1			1	2		
CO2		2			3				3					1	
CO3	1	3		3			2				3				2
CO4				2	3			3				2		3	
CO5		3				3					3		2		

Course Topic(s)

UNIT 1: HIGH SPEED NETWORKS

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection – ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet – Gigabit Ethernet– Fiber Channel – Wireless LAN's, WiFi and WiMax Networks applications, requirements – Architecture of 802.11. **UNIT 2: CONGESTION AND TRAFFIC MANAGEMENT**

Queuing Analysis – Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.**UNIT 3: TCP AND ATM CONGESTION CONTROL**

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance ofTCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR ratecontrol, RM cell formats – ABR Capacity allocations – GFR traffic management. **UNIT 4: INTEGRATED AND DIFFERENTIATED SERVICES**

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services. **UNIT 5: PROTOCOLS FOR QOS SUPPORT9 Hours**

RSVP – Goals & Characteristics, Data Flow, RSVP operations – Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking – Protocol details – RTP – Protocol Architecture – Data Transfer Protocol– RTCP.

TEXTBOOKS

1. William Stallings, "High speed networks and internet", Second Edition, Pearson Education, 2002.

REFERENCES:

1. Warland, PravinVaraiya, "High performance communication networks", Second Edition, Jean Harcourt Asia Pvt. Ltd., , 2001.
2. IrvanPepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad Band TelecommunicationNetworks", CRC Press, New York., 2010

214INT2306	INTRODUCTION TO STORAGE MANAGEMENT	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• Understand Storage Area Networks characteristics and components. • Describe the challenges associated with data center networking and the need for switch network convergence. • Storage Area Networks including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center.						
Course Outcome(s)							
CO1	Identify and describe challenges in data storage and data management.						
CO2	Discuss different types of logical and physical components of a storage infrastructure.						
CO3	Understand benefits of the different network storage options for different application environments.						
CO4	Identify and analyzes the common threats in each domain.						
CO5	Know about the virtualization Techniques.						

Mapping of COs with Pos														
COs	PO's											PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2		3		3					1	2		
CO2	1	3	2						3					1	
CO3	1	3										1			2
CO4		3	3					3						3	
CO5		3	3									1	2		

Course Topic(s)

UNIT 1: INTRODUCTION TO STORAGE TECHNOLOGY

Review data creation and the amount of data being created and understand the value of data to business - challenges in data storage and data management - Solutions available or data storage - Core elements of a data center infrastructure - role of each element in supporting business activities.

UNIT 2: STORAGE SYSTEMS

Hardware and software components of the host environment - Key protocols and concepts used by each component - Physical and logical components of a connectivity environment Major physical disk - access characteristics - and performance implications

UNIT 3: NETWORKED STORAGE

Evolution of networked storage – Architecture – Components - and topologies of FC-SAN, NAS, and IP-SA Benefits of the different networked storage options -Understand the need for

long-term archiving solutions

UNIT 4: DATA CENTER

List reasons for planned/unplanned outages and the impact of downtime - impact of downtime - Differentiate between business continuity (BC) and disaster recovery (DR) - RTO and RPO - Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures - Architecture of backup/recovery and the different backup/recovery topologies- key management tasks in a data center.

UNIT 5: VIRTUALIZATION

Virtualization technologies – block-level and file-level virtualization technologies and Processes

TEXT BOOK

1. EMC, EMC Education Services, Lastemc, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", John Wiley and Sons, 2010.

REFERENCES

1. Robert Spalding, **"**Storage Networks: The Complete Reference". Tata McGraw Hill, Osborne, 2003
2. Marc Farley, "Building Storage Networks", 2nd Edition, Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Limited, 2002.

214INT2307	PRINCIPLES AND PRACITIES OF COMMUNICATION SYSTEM	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To explain QoS requirements and compare different approaches to QoS. • To appreciate need for high speed networks • To identify reliability issues and provide solutions						
Course Outcome(s)							
CO1	Demonstrate the knowledge of fundamental elements and concepts related to Communication System.						
CO2	Address the challenges imposed on different types of Communication Systems.						
CO3	Use and apply important methods in communication systems to support both analog and digital communication.						
CO4	Provide solutions to digital communication by using different modulation techniques.						
CO5	Understand the concepts of digital transmission techniques						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2				3	3		1					1		1	
CO3	3	3					1					1			2
CO4	3	1												3	
CO5							2						2		

Course Topic(s)

UNIT 1: INTERNETWORKING

IPv6 - Design issues - Scalability - Addressing - Headers - Routing - Auto configuration - Transition from IPv4 to IPv6 - Interoperability - QoS in IPv6 - Multicast support - ICMPv6 - Security in IPv6

UNIT 2: QUALITY OF SERVICE

QoS taxonomy - Resource allocation - Scheduling - Queuing disciplines - Delay Analysis Integrated services - Differentiated services - RSVP.

UNIT 3: **MPLS AND VPN**

MPLS Architecture - MPLS to GMPLS - Traffic engineering with MPLS - QoS -Network

recovery and restoration with MPLS – VPN L2 – VPN L3 .

UNIT 4: **OPTICAL NETWORKS**

Photonic Packet switching - WDM network design - Introduction to optical networks -optical layer - SONET/SDH - Optical packet switching - Client layers - Signaling protocols and network operation

UNIT 5: SOFTWARE DEFINED NETWORKING

Introduction to SDN - Network Function Virtualization - Data Plane- Control Plane - SDN software stack - Data center Traffic Management

TEXT BOOKS:

1. Larry L. Peterson, Bruce S. Davie, ―Computer Networks: A Systems Approach‖, Fifth Edition, Elsevier/Morgan Kaufmann Publishers, 2011.
2. Bruce S. Davie, Adrian Farrel, ―MPLS: Next Steps‖, Morgan Kaufmann Publishers, 2011.
3. Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki, "Optical Networks A Practical Perspective " ,Third Edition, Morgan Kaufmann,2010.

EFERENCES:

1. William Stallings, “High-speed networks and internets ", Second Edition Pearson Education India, 2002.
3. Ying-Dar Lin , Ren-Hung Hwang , Fred Baker , "Computer Networks: An Open Source Approach", McGraw-Hill Higher Education, 2011.

214INT3302	MULTIMEDIA CODING AND COMMUNICATION	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To introduce the Significance and the role of embedded system for automation. • To understand the embedded system role in IOT and use it for application development. • To observe the need for smart cities and systems • To introduce the automotive embedded systems • To observe the evolving trend in communication based automotive systems.						
Course Outcome(s)							
CO1	Describe technical characteristics and performance of multimedia system and terminals						
CO2	Design creative approach in application of multimedia devices, equipment and systems						
CO3	Interpret and analyse measurement results obtained on the multimedia system and components						
CO4	Describe the development process and applications of the multimedia systems						

Mapping of COs with Pos														
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2		3		3					1	2		
CO2	1	3	2						3					1	
CO3	1	3										1			2
CO4		3	3					3						3	
CO5		3	3									1	2		

Course Topic(s)

Unit I- Multimedia Overview: Introduction, Multimedia presentation and production, Multimedia and hypermedia, Hardware and software requirements, uses of multimedia, Multimedia Authoring, Editing and authoring tools. Components of Multimedia: Text – types, Unicode standard on file format; Image and graphics, data types, file formats, color science and color model; Audio- digitization, midi, quantization and transformation of audio; Video- types ofvideo signals, analog and digital video, television broadcast standards, pc video; animation-

types, principals and techniques, 3D animation, camera, special effects, rendering.

Unit II-Lossless Compression Techniques: Introduction, Run-length coding, Variable length coding (Shannon-Fano, Huffman, adaptive Huffman), Dictionary based coding, Arithmetic coding, Lossless image compression.

Unit III-Lossy Compression Techniques: Introduction, Distortion measure, Quantization, transform coding, Wave-let based coding, Wavelet packets. Elements of Image Compression System and Standards: JPEG standard, JPEG-2000 standard, JPEG-LS standard, Bi-level Image Compression standard.

Unit -IV: Video Coding and Compressing Standards: Introduction, Motion estimation, MPEG-1, MPEG-2, MPEG-4, MPEG-7 etc. Audio compression Standards: ADPCM, psychoacoustics, MP3, MPEG.

Unit V-Multimedia communication and Retrieval: Basics of networks, multiplexing technologies, LAN, WAN, ATM, quality of multimedia data transmission, multimedia over IP (RTP, RTCP, RSVP, RTSP), multimedia over ATM networks. Multimedia architecture: User interface, distributed multimedia application, Play back architecture, temporal relationship, synchronization, multimedia database system, feature extract of image, audio, video.

Reference Book:

i) Fundamentals of Multimedia By Ze-Nian Li & Mark S. Drew

ii) Multimedia Computing communications & Applications By Ralf Stiemetz

iii) Multimedia Communications: Applications, Networks, Protocols and Standards By Fred Halsall

REFERENCES:

4. Rajkamal, ‘Embedded system-Architecture, Programming, Design’, TMH,2011
5. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2007.
6. MehrdadEhsani, ‘Modern Electric, Hybrid Electric and Fuel cell vehicles’, CRC Press Second edition 2011
7. Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti (Universities Press) Research papers, 2014.

214INT2308	SOFTWARE TESTING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Electives						
Course Type	Integrated Course with Theory						
Objective(s)	• This course helps to understand theories, methods, and technologies applied for professional software development. • To define software engineering and explain its importance To discuss the concepts of software products and software processes						
Course Outcome(s)							
CO1	Analyze and identify an appropriate process model for a given project						
CO2	Understand the principles at various phases of software development						
CO3	Understand the software project estimation models and estimate the work to be done, resources required and the schedule for a software project						
CO4	Translate specifications into design, and identify the components to build the architecture for a given problem, all using an appropriate software engineering methodology						
CO5	Define a Project Management Plan and tabulate appropriate Testing Plans at different levels during the development of the software						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1		3					3					2		
CO2		2	3			2	3				3			1	
CO3		3	1			3									2
CO4					3					3				3	
CO5							3				3		2		

Course Topic(s)

UNIT 1 : SOFTWARE ENGINEERING CONCEPTS

Software and Software Engineering - Project Management Concepts - Software Engineering Paradigms – Generic Process Models, Assessment and Improvement - Water Fall Life Cycle Model - Prototype Model - RAD Model - Spiral Model - Incremental Model –Requirements Engineering

UNIT 2: MANAGING SOFTWARE PROJECTS

Metrics : Metrics in Process and Project Domains - Software Measurement - Metrics for Software Quality - Integrating Metrics in a Software Engineering Process - Estimation , Scheduling – Risk Management – Review Techniques - Software Quality Assurance

UNIT 3 : DESIGN CONCEPTS

Design Process - Design Principles - Design Concepts - Software Architecture – Architectural Style, Design and Mapping - User Interface Design

UNIT 4: 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 – Software Configuration Management

UNIT 5 : ADVANCED TOPICS

Computer Aided Software Engineering - Clean room software engineering – Reengineering - Reverse Engineering

PRACTICAL COMPONENTS

1. Introduction to UML (Unified Modeling Language)
    b) Visualizing
    c) Specifying
    d) Constructing
    e) Documenting
2. Program Analysis and Project Planning : Study of Problem definition – Identification of project Scope, Objectives, Infrastructure
3. Preparation of System Requirement Specification (SRS) and related analysis documents as Per the guidelines in ANSI/IEEE Std 830-1984.
4. Create UML Diagrams (Use diagrams, Activity diagrams, Class diagrams, Sequence diagrams)
5. Software Development (Implementation)
6. Software Testing and Prepare test plan,
7. Execution of Test cases.
8. Debugging and demonstration.

TEXTBOOK

1. Roger S. Pressman, “Software Engineering: A Practitioner's Approach”, seventh Edition, Mc-Graw Hill, 2014.

REFERENCE BOOKS

1. Steve McConnell, “Code Complete”, Second Edition, Microsoft Press.2004
2. Ian Somerville, “Software Engineering”, Addison-Wesley, Ninth edition, 2011.
3. Richard E. Fairley, “Software Engineering Concepts”, Second Edition McGraw- Hill, 1985.

214INT1306	IT in BUSINESS	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Elective						
Course Type	Integrated Course with Theory						
Objective(s)	Enable the students coming from different graduation streams to understand the working and management of business.						
Course Outcome(s)							
CO1	Understand relationship between environment and business; Applying the environmental analysis techniques in practice						
CO2	Understand Economic, Socio-Cultural and Technological Environment						
CO3	Know state policies Economic legislations and Economic reforms laid by the government						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2				3	3		1					1		1	
CO3	3	3					1					1			2

Course Topic(s)

UNIT 1: Information systems and strategic implications Data information systems Difference between data and information Information system activities and resources System approaches Organizational sub-systems Support system Systems application in strategy building

UNIT 2: Functional and enterprise systems Management Information systems Types of operating systems - Functional and cross functional systems Organizational sub systems - Transactional processing information systems - Accounting and finance systems - Marketing andsales systems - Production and operation management systems - Human resources management systems - e-CRM - SCM - KMS - ERP - BPR

UNIT 3: Introduction to E-Business Electronic Business Electronic Commerce Electronic commerce models Types of electronic commerce Value chains in Electronic commerce E-Commerce in India Internet World Wide Web Internet architectures Internet applications Web based tools for electronic commerce Intranet Composition of Intranet Business application on Intranets Extranets Electronic Data Interchange - Components of Electronic Data Interchange - Electronic Data Interchange communication process

UNIT 4:Database management Systems Systems Analysis and Design DSS and ES Software for

Decision Support Group Decision making Enterprise Wide computing Object oriented analysis and design

UNIT 5: Need for security Security techniques - Firewalls - Encrypting Cyber terrorism and other measures preventing misuse of IT

TEXT BOOKS:

1. Ralph StiaranGeorge Reynolds, Fundamentals of IT,Thompson
2. Introduction to IT, Pearson
3. Williams ans sawyer, IT, TMH
4. Carroll Frenzel and John Frenzel, MIS, Thompson
5. WananJawadekar,MIS, TMH
6. Ashok Arora and Akshya Bhatia, MIS,EB
7. MahadeoJaiswal and Monika Mital, MIS, Oxford

214INT2309	EMBEDDED C PROGRAMMING	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Professional Elective						
Course Type	Integrated Course with Theory						
Objective(s)	Aims to provide the practical and theoretical skills needed to use C language to program embedded microprocessors and systems.						
Course Outcome(s)							
CO1	Identify Embedded C software components and know how they are different from standard C software components						
CO2	Execute how to break big problems into small problems using functions and recursive functions						
CO3	Utilize hardware/software signaling mechanism to implement effective communication between embedded software stack and hardware using the concept of array.						
CO4	Understand embedded controller hardware and software stack and their respective differences from traditional software development using the concept of pointer						
CO5	Comprehend hardware communication protocols for implementation with other peripheral hardware devices such as GPIO, ADC, and Serial I/O						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2				3	3		1					1		1	
CO3	3	3					1					1			2
CO4	3	1												3	
CO5							2						2		

Course Topic(s)

UNIT I OVERVIEW

C Overview and Program Structure; Constants-Bits & Bytes, Syntax of C Constants; Preprocessor Directives- Standard Preprocessor Directives; Data Variables and Types- Data Types; Expressions and Operators; Statements-Definitions, Side Effects, Nesting, Indentation

and use of braces, Design documentation, Program complexity.

UNIT II FUNCTIONS

Main() function, Function definition, parameters, Advanced features, Return values, Inline functions, Nested functions, Recursive functions, sequence points, well-structured programs, design documentation, Implementations

UNIT III ARRAYS AND STRUCTURES

Arrays- Array Initializers, Constant Arrays, String variables, Dimensionless arrays, Multidimensional arrays, Index Range, Example Array usage, Lookup table, Searching and Sorting Arrays; Structures- Structure Nesting and Arrays, Structure Layout in memory, Bit Field, Unions, Example of Structure in a program.

UNIT IV STRINGS, MEMORY AND POINTERS

String- String copy and length, String Search, String compare, String Manipulation, String Input and Output, String conversion to/from Numbers, Character Manipulation, and Constant String Manipulation; Memory and Pointers- Memory, Address of operator, Indirection operator, Forcing a variable address, Pointer types, Pointer math, Back to subscripts, Back to function parameters, Back to structures, Function pointers, Other uses of pointers, ROM pointers, User- defined memory, Compatible note, over the Hill.

UNIT V PIC MICROCONTROLLER AND INTERFACING

PIC Microcontroller, Assembly Language Instructions, Pin Configuration, GPIO Programming-Registers, Interfacing of Relays, Buzzer, switch, LEDs, Basics of LCD Interfacing, 16x2 LCD Features and Pin Diagram, LCD Interfacing Embedded C Program, 4x4 Matrix Keyboard Interfacing, Stepper Motor Interfacing.

TEXT BOOK

1. Mark Siegesmund, “Embedded C Programming Techniques and Applications of C and PIC MCUS”, ScienceDirect, Elsevier, 2015.
2. Matrin P. Bates, “Programming 8-bit PIC Microcontrollers in C with interactive Hardware simulation”, Newnespress, Second Edition, 2018

214INT2310	EMBEDDED SYSTEM AUTOMATION	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Open Elective						
Course Type	Integrated Course with Theory						
Objective(s)	• To introduce the Significance and the role of embedded system for automation. • To understand the embedded system role in IOT and use it for application development. • To observe the need for smart cities and systems • To introduce the automotive embedded systems • To observe the evolving trend in communication based automotive systems.						
Course Outcome(s)							
CO1	Ability to understand hardware and software requirements in embedded systems.						
CO2	Ability to do develop data management through cloud interface with processor technology						
CO3	Learn the development smart system solutions and analyse issues.						
CO4	Ability to understand the types of sensors and Bus for control implementation.						
CO5	Capacity to involve communication concepts for vehicle application development.						

Mapping of COs with Pos														
COs	PO's											PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2		3		3					1	2		
CO2	1	3	2						3					1	
CO3	1	3										1			2
CO4		3	3					3						3	
CO5		3	3									1	2		

Course Topic(s)

UNIT I EMBEDDED SYSTEMS DESIGN

Overview of Embedded system - Design process in embedded system- Communication Protocols Embedded SOC- RTOS- Embedded product Development Life Cycle.

UNIT II EMBEDDED SYSTEM FOR IOT

Overview of IOT- Sensing- Actuation- IOT Networking- Communication protocols-data handling and analytics- cloud computing- Implementation of IOT with Raspberry pi- Industrial IOT.

UNIT III EMBEDDED SYSTEMS AND IOT APPLICATIONS

Embedded system for Smart Meter- smart Grid -Smart cities and smart homes, Agriculture and Healthcare, Energy auditing.

UNIT IV EMBEDDED SYSTEM FOR AUTOMOTIVE SYSTEM

Electronic control Unit – Vehicle Management Systems- Sensors-Actuators-Vehicle Communication protocols –Infotronics- Introduction to AUTO SAR.

UNIT V ADVANCES IN AUTOMOTIVE ELECTRONIC SYSTEMS

Introduction to electric and hybrid vehicles – onboard diagnostics- Connected Cars technology - Autonomous vehicles - Safety and Collision Avoidance – Navigation support for vehicles- Battery Management- Plug in Electrical vehicle- Charging station- Solar powered vehicles.

TEXT BOOKS:

4. Peckol, “Embedded system Design”,JohnWiley&Sons,2010
5. William B. Ribbens, Understanding Automotive Electronics, 6th edition, YES DEE Publishing Private Limited, 2011.
6. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press), 1st Edition , 2017

REFERENCES:

8. Rajkamal, ‘Embedded system-Architecture, Programming, Design’, TMH,2011
9. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2007.
10. MehrdadEhsani, ‘Modern Electric, Hybrid Electric and Fuel cell vehicles’, CRC Press Second edition 2011
11. Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti (Universities Press) Research papers, 2014.

214INT2311	SYSTEM ON CHIP DESIGN	L	T	P	X	C	H
		2	0	2	0	3	4
Prerequisite	Nil						
Course Category	Elective						
Course Type	Integrated Course with Theory						
Objective(s)	With technological advances that allow us to integrate complete multi-processor systems on a single die, Systems-on-Chip (SoCs) are at the core of most embedded computing and consumer devices, such as cell phones, media players and automotive, aerospace or medical electronics. This course will provide an understanding of the concepts, issues, and process of designing highly integrated SoCs following systematic hardware/software co-design & co-verification principles.						
Course Outcome(s)							
CO1	Memorize the system architecture, components of system hardware and software.						
CO2	Know the basic concepts of processor architecture and instructions and delays.						
CO3	Describe external and internal memory of SOC and organization.						
CO4	Explain bus architectures, models of SOC and Know SOC customization and reconfiguration technologies.						
CO5	Apply the knowledge of SOC design in real time applications						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2				3	3		1					1		1	
CO3	3	3					1					1			2
CO4	3	1												3	
CO5							2						2		

Course Topic(s)

UNIT-I: SOC FUNDAMENTALS

Essential issues of SoC design – A SoC for Digital still camera – multimedia IP development : Image and video codecs.

UNIT-II: SOC SOFTWARE AND ENERGY MANAGEMENT

SoC embedded software – energy management techniques for SoC design

UNIT-III: SYSTEM DESIGN AND METHODOLOGY

Design methodology for NOC based systems – Mapping concurrent application onto architectural platforms.

UNIT-IV: HARDWARE AND BASIC INFRASTRUCTURE

Packet switched network for on-chip communication – energy reliability tradeoff for NoC's – clocking strategies – parallel computer as a NoC's region.

UNIT-V: SOFTWARE AND APPLICATION INTERFACES

MP-SoC from software to hardware – NoC APIs – multilevel software validation for NoC – Software for network on chip

REFERENCE BOOKS

1. Axel Jantsch, HannuTenhunen, "Network on chips", Kluwer Academic Publishers, 2003.

2. Youn-Long, Steve Lin, "Essential Issues of SoC Design: Designing Complex Systems-On-Chip", Springer, 2006

Courses for Honour Students

213INT4101	ADVANCED NETWORKS	L	T	P	X	C	H
		4	0	0	0	4	4
Prerequisite	Data Communications and Computer Networks (212INT3301)						
Course Category	Honours Elective						
Course Type	Theory						
Objective(s)	• To explain QoS requirements and compare different approaches to QoS. • To appreciate need for high speed networks • To identify reliability issues and provide solutions						
Course Outcome(s)							
CO1	Gain an understanding of advanced networks concept.						
CO2	Describe the principles behind the enhancement in networking						
CO3	Know the recent development in networks						
CO4	Know the optical network design						
CO5	Know the virtualization.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2				3	3		1					1		1	
CO3	3	3					1					1			2
CO4	3	1												3	
CO5							2						2		

Course Topic(s)

UNIT 1: INTERNETWORKING

IPv6 - Design issues - Scalability - Addressing - Headers - Routing - Auto configuration - Transition from IPv4 to IPv6 - Interoperability - QoS in IPv6 - Multicast support - ICMPv6 - Security in IPv6

UNIT 2: QUALITY OF SERVICE

QoS taxonomy - Resource allocation - Scheduling - Queuing disciplines - Delay Analysis Integrated services - Differentiated services - RSVP.

UNIT 3: **MPLS AND VPN**

MPLS Architecture - MPLS to GMPLS - Traffic engineering with MPLS - QoS -Network recovery and restoration with MPLS – VPN L2 – VPN L3 .

UNIT 4: **OPTICAL NETWORKS**

Photonic Packet switching - WDM network design - Introduction to optical networks -optical layer - SONET/SDH - Optical packet switching - Client layers - Signaling protocols and network operation

UNIT 5: SOFTWARE DEFINED NETWORKING

Introduction to SDN - Network Function Virtualization - Data Plane- Control Plane - SDN

software stack - Data center Traffic Management

TEXT BOOKS:

1. Larry L. Peterson, Bruce S. Davie, ―Computer Networks: A Systems Approach‖, Fifth Edition, Elsevier/Morgan Kaufmann Publishers, 2011.
2. Bruce S. Davie, Adrian Farrel, ―MPLS: Next Steps‖, Morgan Kaufmann Publishers, 2011.
3. Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki, "Optical Networks A Practical Perspective " ,Third Edition, Morgan Kaufmann,2010.

EFERENCES:

1. William Stallings, “High-speed networks and internets ", Second Edition Pearson Education India, 2002.
3. Ying-Dar Lin , Ren-Hung Hwang , Fred Baker , "Computer Networks: An Open Source Approach", McGraw-Hill Higher Education, 2011.

213INT4102	AGENT BASED INTELLIGENT SYSTEMS	L	T	P	X	C	H
		3	1	0	0	4	4
Prerequisite	Artificial Intelligence (212INT2308)						
Course Category	Honours Elective						
Course Type	Theory						
Objective(s)	• The structure of agents • The learning mechanisms of agents • The communication and cooperation within agents • The design of agents						
Course Outcome(s)							
CO1	Implement a computational agent with various searching techniques						
CO2	Apply the reasoning mechanisms of proposition and predicate logic to agents						
CO3	Use the learning mechanisms for an artificial agent.						
CO4	Execute different communication and co-operation methodologies in a multi-agent setup.						
CO5	Know about the agents design.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3											2		
CO2		3	3	1	2									1	
CO3		2	3	2											2
CO4						3		2			2	1		3	
CO5		3	1		3						3	2	2		

Course Topic(s)

UNIT 1: INTRODUCTION

Agents as a paradigm for software engineering - Agents as a tool for understanding human societies- Intelligent Agent: Agents and Objects - Agents and Expert Systems - Agents as Intentional Systems - Abstract Architectures for Intelligent Agents - How to Tell an Agent What to Do

UNIT 2: LEARNING IN AGENTS

Proportional case - Handling variables and qualifiers - Dealing with intractability - Reasoning with horn clauses - Procedural control of reasoning - Rules in production – Reasoning with Higher order Logics.

UNIT 3: **COMMUNICATION AND COOPERATION IN AGENTS**

Software tools for ontology - OWL - XML - KIF - Speech acts - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Result Sharing - Combining Task and Result Sharing - Handling Inconsistency - Coordination - Multi agent Planning andSynchronization

UNIT 4: **DEVELOPING INTELLIGENT AGENT SYSTEMS**

Situated Agents: Actions and Percepts - Proactive and Reactive Agents: Goals and Events -

Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle - Deciding on the Agent Types - Grouping functionalities - Review Agent Coupling - Acquaintance Diagrams - Develop Agent Descriptors

UNIT 5: **APPLICATIONS**

Agent for workflow and business process management- Mobile agents - Agents for distributed systems - agents for information retrieval and management - agents for electronic commerce - agent for human- computer interface - agents for virtual environments - agents for social simulation**.**

TEXT BOOKS:

1. Michael Wooldridge, "An Introduction to Multi Agent Systems", Second Edition, John Wiley and Sons, 2009.

2. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Pearson Education, 2009.

3. Lin Padgham, Michael Winikoff, "Developing Intelligent Agent Systems: A Practical Guide", Wiley publications, 2005

REFERENCES:

1. Ronald Brachman, Hector Levesque , "Knowledge Representation and Reasoning", The Morgan Kaufmann Series in Artificial Intelligence 2004
2. Arthur B. Markman, "Knowledge Representation", Lawrence Erlbaum Associates,1998

213INT3105	COMPUTATIONAL LINGUISTICS	L	T	P	X	C	H
		3	1	0	0	4	4
Prerequisite	Python for Programming and Product Development (211CSE1401)						
Course Category	Honours Elective						
Course Type	Theory						
Objective(s)	• Learn about the statistical modeling and classification for NLP • Learn the basic techniques of information retrieval • Know about the basics of text mining • Learn the generic issues in speech processing and applications relevant to natural language generation						
Course Outcome(s)							
CO1	Develop applications related to speech processing.						
CO2	To know about the basic techniques of information retrieval.						
CO3	Develop applications related to text mining.						
CO4	Know about the generic issues in speech processing.						
CO5	Develop applications relevant to natural language generation						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3											2		
CO2		3	2		1									1	
CO3		2	2	3		1									2
CO4		3										1		3	
CO5		3				1					3	1	2		

Course Topic(s)

UNIT 1: NATURAL LANGUAGE PROCESSING

Linguistic background - spoken language input and output technologies - Written language input - Mathematical methods - Statistical modeling and classification - Finite state methods: Grammar for NLP - Parsing - Semantic interpretation: Semantics and logical form - Ambiguity Resolution - Other strategies for semantic interpretation - Word Sense Disambiguation - Named Entity Recognition

UNIT 2: **INFORMATION RETRIEVAL**

Information Retrieval architecture - Indexing - Storage - Compression techniques - Retrieval approaches - Evaluation - Search Engines - Commercial search Engine features - comparison - Performance measures - Document processing - NLP based Information Retrieval - Information Extraction - Vector Space Model

UNIT 3: **TEXT MINING**

Categorization : Extraction based Categorization - Clustering - Hierarchical clustering - Flat Clustering - Document classification and routing - Finding and organizing answers from text search - Categories and clusters for organizing retrieval results - Text Categorization - Efficient summarization using lexical chains - Pattern extraction

UNIT 4: **GENERIC ISSUES**

Multilinguality - Multilingual Information Retrieval and Speech Processing - Multimodality- Text and Images - Modality Integration - Transmission and storage - Speech coding - Evaluation of systems - Human factors and user acceptability.

UNIT 5: **APPLICATIONS**

Machine translation - Transfer metaphor - Interlingua and statistical approaches - Discourse processing - Dialog and conversational agents - Natural language generation - Surface Realization and discourse planning

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin, " Speech and Language Processing", Pearson Education, 2009.
2. Ronald Cole, J.Mariani, et.al, "Survey of the state of the art in human language Technology", Cambridge University Press, 1997.
3. Michael W.Berry, " Survey of Txt Mining: Clustering, Classification and Retrieval", SpringerVerlag, 2004.

REFERENCES:

1. James Allen, "Natural Language Understanding", Second Edition, Pearson Education, 2008.
2. Gerald J.Kowalski, Mark. T. Maybury, " Information Storage and Retrieval systems" , Kluwer Academic Publishers, 2000.
3. TomekStrzalkowski, " Natural Language Information Retrieval", Kluwer Academic Publishers, 2009.

213INT1111	E-LEARNING TECHNIQUES	L	T	P	X	C	H
		4	0	0	0	4	4
Prerequisite	Nil						
Course Category	Honours Elective						
Course Type	Theory						
Objective(s)	• To gain knowledge about modern technology for learning. • To be acquainted with e-Learning Tools. • To learn technologies involved in e-learning application development. • To become aware of the current business potential of e-learning based business						
Course Outcome(s)							
CO1	Work with technologies involved in e-Learning Applications						
CO2	Design and Develop e-Learning Application						
CO3	Know about the E-Learning tools.						
CO4	Develop web based E-learning methods.						
CO5	Know about the learning methodology.						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3				3						3	2		
CO2	2	3	3											1	
CO3	1	3	3												2
CO4		3	3	3	1						2	3		3	
CO5			3	3	1						2	2	2		

Course Topic(s)

UNIT 1: INTRODUCTION

Definition – Benefits – Challenges & opportunities- Developing E-learning-E-learning approachesE-learning components-Synchronous and asynchronous e-learning-Quality of e-learning-Blended learning- ROI metrics & evaluation – E-Learning cycle – Learning strategy – Business drivers – Elearning strategy.

UNIT 2: DESIGN

Identifying and organizing course content-Needs analysis- Analyzing the target audienceIdentifying course content-Defining learning objectives-Defining the course sequence-Defining instructional, media, evaluation and delivery strategies-Defining instructional methods, Defining the delivery strategy, Defining the evaluation strategy. Instructional design – Design issues – Types of learning engagements – Blended learning – Team – Infra structure – Vendor relationships.

UNIT 3: CREATING INTERACTIVE CONTENT

Multi-channel delivery – Learner support – Developing curriculum – E-learning standards – Content development process- Creating storyboards-Structure of an interactive e-lesson Techniques for presenting content-Integrating media elements-Courseware development

Authoring tools-Types of authoring tools-Selecting an authoring tool.

UNIT 4: **WEB BASED TRAINING**

Definition – Need for web based training – Choosing an approach - Kind of courses – Technical standards – Metaphors – Course framework – registration – Running the course – resources – Feedback – Access - Collaborative learning- Moodle and other open-source solutions - E- learning methods.

UNIT 5: **LEARNING METHODOLOGY**

Organizing learning sequences – Common lesson structures – Creating building blocks – Designing learning sequences – Learning activities – Test and exercise learning – Planning tests – Selecting questions – Sequencing test questions – Feedback – Improve testing – Prevent cheating.

TEXT BOOKS:

1. Clark, R. C. and Mayer, R. E. , " eLearning and the Science of Instruction". PHI 3rd edition, 2011

2. Means, B., Toyama, Y., and Murphy, R. "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies", 2010

REFERENCES:

1 Crews, T. B., Sheth, S. N., and Horne, T. M "Understanding the Learning Personalities of Successful Online Students" Educause Review. Jan/Feb 2014.

2. MadhuriDubey,‖Effective "E-learning Design,Development and Delivery",University Press 2011.

213INT3106	HETEROGENEOUS COMPUTING	L	T	P	X	C	H
		4	0	0	0	4	4
Prerequisite	Computer Organization and Assembly Language Programming (212INT1101)						
Course Category	Honours Elective						
Course Type	Theory						
Objective(s)	• To learn about the development of massively parallel systems • To learn about the challenges in heterogeneous processing systems • Learn to program heterogeneous systems • Learn to provide effective parallel solutions for GPGPU architectures						
Course Outcome(s)							
CO1	Identify parallelism in an application						
CO2	Choose the right parallel processing paradigm for a given problem						
CO3	Devise solutions for an application on a heterogeneous multi-core platform						
CO4	Program using CUDA and Open MP						
CO5	Know about the effective parallel solutions for GPGPU architectures						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	1										2		
CO2		3	1	3										1	
CO3			3		3						1	1			2
CO4		2			3						2	1		3	
CO5		3	1								1	3	2		

Course Topic(s)

UNIT 1: PARALLEL COMPUTING BASICS

Importance of parallelism – Processes, tasks and threads - Modifications to von-Neumann model – ILP, TLP - Parallel hardware – Flynns classification – Shared memory and distributed memory architectures - Cache Coherence - Parallel software – Performance – Speedup and scalability – Massive parallelism - GPUs - GPGPUs

UNIT 2: SHARED MEMORY PROGRAMMING WITH OpenMP

OpenMP program structure - OpenMP Clauses and directives – Scheduling primitives – Synchronization primitives – Performance issues with caches - Case study – Tree Search

UNIT 3: PROGRAMMING GPUS

GPU architectures - Data parallelism - CUDA Basics – CUDA program structure - Threads, Blocks, Grids - Memory handling

UNIT 4: **PROGRAMMING WITH CUDA**

Parallel patterns – Convolution – Prefix sum – Sparse matrix-vector multiplication – Imaging case study

UNIT 5: **OTHER GPU PROGRAMMING PLATFORMS**

Introduction to Open CL – Open ACC – C++AMP – Thrust – Programming Heterogeneous

clusters – CUDA and MPI

TEXT BOOKS:

1. Peter Pacheco, ―Introduction to parallel programming‖, Morgan Kauffman, 2011.
2. David B. Kirk, Wen-mei W. Hwu, ―Programming massively parallel processors‖, Morgan Kauffman, 2013, 2nd Edition

REFERENCES:

1. Shane Cook, ―CUDA Programming – A developers guide to parallel computing with GPUs‖, Morgan Kauffman, 2013.
2. B.R. Gaster, L. Howes, D.R. Kaeli, P. Mistry, D. Schaa, ― Heterogeneous computing with OpenCL‖, Morgan Kauffman, 2012.

213INT3107	PATTERN RECOGNITION	L	T	P	X	C	H
		3	1	0	0	4	4
Prerequisite	Data Warehousing and Mining (213INT1305)						
Course Category	Honours Elective						
Course Type	Theory						
Objective(s)	• To know about supervised and unsupervised Learning. • To study about feature extraction and structural pattern recognition. • To explore different classification models. • To learn about fuzzy pattern classifiers and perception						
Course Outcome(s)							
CO1	Classify the data and identify the patterns						
CO2	Extract feature set and select the features from given data set.						
CO3	Learn about feature extraction and structural pattern recognition						
CO4	Know about the different classification models						
CO5	Know about fuzzy pattern classifiers and perception						

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		3	3	2		1					1	2		
CO2	3	3					1							1	
CO3	3		3												2
CO4	3	1												3	
CO5							2						2		

Course Topic(s)

UNIT 1: PATTERN CLASSIFIER

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT 2: CLUSTERING

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validityof Clusters.

UNIT 3: **FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION**

KL Transforms – Feature selection through functional approximation – Binary selection - Elements of formal grammars - Syntactic description - Stochastic grammars - Structural representation.

UNIT 4: **HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE**

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT 5: **RECENT ADVANCES**

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

TEXT BOOKS:

1. M. Narasimha Murthy and V.Susheela Devi, ―Pattern Recognition‖, Springer 2011. 2. S.Theodoridis and K.Koutroumbas, ―Pattern Recognition‖, 4th Edition., Academic Press, 2009

REFERENCES:

1. Robert J.Schalkoff, ―Pattern Recognition Statistical, Structural and Neural Approaches‖, John Wiley & Sons Inc., New York, 1992.
2. C.M.Bishop,―Pattern Recognition and Machine Learning‖, Springer, 2006.
3. R.O.Duda, P.E.Hart and D.G.Stork, ―Pattern Classification‖, John Wiley, 2001.
4. Andrew Webb, ―Stastical Pattern Recognition‖, Arnold publishers, London, 1999.

213INT4103	VISUALIZATION TECHNIQUES	L	T	P	X	C
		3	1	0	0	4
Prerequisite	Artificial Intelligence (212INT2308)					
Course Category	Honours Elective					
Course Type	Theory					
Objective(s)	• To learn about the importance of data visualization. • To know the different types of visualization techniques. • To create various visualizations					
Course Outcome(s)						
CO1	Compare various visualization techniques.					
CO2	Design creative visualizations					
CO3	Apply visualization over different types of data.					
CO4	Study about types of visualization.					
CO5	Create various visualizations					

Mapping of COs with Pos															
COs	PO's												PSO's		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	2									2	2		
CO2	1	3	2											1	
CO3	3	3	2												2
CO4	1	3												3	
CO5	1	3	2									3	2		

Course Topic(s)

UNIT 1: INTRODUCTION

Introduction – Issues – Data Representation – Data Presentation – Common Mistakes in design.

UNIT 2: FOUNDATIONS FOR DATA VISUALIZATION

Visualization stages – Experimental Semiotics based on Perception Gibson_s Affordance theory – A Model of Perceptual Processing – power of visual perception-Types of Data-visualization and data objects.

UNIT 3: **COMPUTER VISUALIZATION**

Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3Ddata – Interacting with visualization

UNIT 4: **MULTIDIMENSIONAL VISUALIZATION**

One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.

UNIT 5: **CASE STUDIES**

Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

TEXT BOOKS:

1. Colin Ware, ―Information Visualization Perception for Design‖ MargonKaufmann Publishers, 2004, 2nd edition.
2. Robert Spence ―Information visualization – Design for interaction‖, Pearson Education, 2 nd Edition, 2007
3. Stephen Few, ―Information Dashboard Design-The Effective Visual Communication of Data‖: O'Reilly Media Publisher,1st Edition 2006

REFERENCES:

1.Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, ―Readings in Information Visualization Using Vision to think‖, Morgan Kaufmann Publishers. 2008