

Bishop Heber College (Autonomous), Tiruchirappalli – 620 017
Department of Information Technology

Programme: M. Sc. (Information Technology)

Programme Outcomes:

After successful completion of the M. Sc. (I. T.) Programme, the students will possess

PO No.	PROGRAMME OUTCOMES
PO1	Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of a Post graduate programme of study
PO2	Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, and beliefs based on empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies, and theories by following scientific approach to knowledge development.
PO3	Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
PO4	Analytical & Scientific Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.
PO5	Research related skills: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned research perspective; Sense of inquiry and capability for asking relevant questions / problem arising / synthesizing / articulating / ability to recognize cause and effect relationships / define problems. Formulate hypothesis, Test / analyse / Interpret the results and derive conclusion, formulation and designing mathematical models
PO6	Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

PROGRAMME SPECIFIC OUTCOMES

After successful completion of the M. Sc. (I. T.) Programme, the students will possess

PO No.	PROGRAMME SPECIFIC OUTCOMES
PSO1	Disciplinary Knowledge: Understand and analyze the fundamental knowledge in the Information Technology domain.
PSO2	Critical Thinking: Enhance logical, analytical and critical thinking to understand and evaluate the various System Architecture, Networks, Security, Data science, Programming Techniques to solve complex computing problems.
PSO3	Problem Solving: Ability to develop software applications to provide real world solutions to solve computer technology related problems.
PSO4	Analytical & Scientific Reasoning: Explore the developing areas in the Information Technology sector and enrich themselves to be skillful to meet the diverse expectations of the industry
PSO5	Research related skills: Equipped to be competent in providing optimal and ethical solutions to the technological challenges laid by professional societies
PSO6	Self-directed & Lifelong Learning: Adapt to employ the life-long learning skills as the technology evolves over the generations in the field of Information Technology.

Bishop Heber College (Autonomous), Tiruchirappalli – 620 017

M. Sc. (Information Technology)

(Syllabus applicable to the students admitted from the academic year 2023 – 2024 onwards)

Eligibility: B.C.A. or B. Sc. Computer Science or B. Sc. Information Technology or B. Sc. Software Development or any other degree with Mathematics as an allied/major subject or with Mathematics or Computer Science or Business Mathematics or Statistics at + 2 level.

Sem	Course	Course Title	Course Code	Credits	Hours Per Week	Marks		
						CIA	ESE	TOTAL
I	Core I	Python Programming	P23IT101	5	7	25	75	100
	Core II - Lab	Python Programming Practical	P23IT1P1	5	7	40	60	100
	Core III – Lab	Web Development using Word Press - Practical	P23IT1P2	4	6	40	60	100
	Elective–I	Data Structures	P23IT1:A	3	5	25	75	100
		Compiler Design	P23IT1:B					
		Natural Language Processing	P23IT1:C					
	Elective–II	Operating Systems	P23IT1:D	3	5	25	75	100
Digital Computer Architecture		P23IT1:E						
Human Computer Interaction		P23IT1:F						
				20	30			
II	Core IV	Relational Database Management Systems	P23IT202	5	6	25	75	100
	Core V - Lab	RDBMS- Practical	P23IT2P3	5	6	40	60	100
	Core VI - Lab	Open-Source Technologies Practical	P23IT2P4	4	6	40	60	100
	Elective–III	Biometric Techniques	P23IT2:A	3	4	25	75	100
		Digital Watermarking and Steganography	P23IT2:B					
		Digital Image Processing	P23IT2:C					
	Elective - IV	Software Engineering	P23IT2:D	3	4	25	75	100
		Object Oriented Analysis and Design	P23IT2:E					
Software Project Management		P23IT2:F						
NMEC – I	Web Concepts	P23IT2E1	2	4	25	75	100	
				22	30			
III	Core VII	Advanced JAVA	P23IT303	5	6	25	75	100
	Core VIII-Lab	Advanced JAVA - Practical	P23IT3P5	5	6	40	60	100
	Core IX-Lab	Mobile Application Development - Practical	P23IT3P6	5	6	40	60	100
	Core X-Lab	Internet of Things - Practical	P23IT3P7	4	6	40	60	100
	Elective–V	Research Methodology	P23IT3:A	3	3	25	75	100
		Internet of Things	P23IT3:B					
		Trends in Computing	P23IT3:C					
	NMEC – II	Multimedia Tools	P23IT3E2	2	3	25	75	100
	Internship / Industrial Activity	P23IT3I1	2	-	100	-	100	
				26	30			
	Core XI	„Net with C# Programming	P23IT404	5	6	25	75	100
	Core XII-Lab	„Net with C# Programming - Practical	P23IT4P8	5	6	40	60	100
	Core XIII-Project	Core Project with Viva-voce	P23IT4PJ	7	8	40	60	100
IV	Elective–VI	Intelligent Systems	P23IT4:A	3	4	25	75	100
		Introduction to Robotics	P23IT4:B					
		Virtual and Augmented Reality	P23IT4:C					
	SEC	Skills Enhancement for IT Professionals and Entrepreneurs	P23IT4S1	2	4	100	-	100
		Extension Activity	P23ETA41	1	-		-	-
	VLO	VLO	P23VLO41/ P23VLO42	2	2	100	-	100
				25	30			
TOTAL				93				

CORE I: PYTHON PROGRAMMING

Code : P23IT101
Semester : I

Hours/Week: 7
Credits: 5

Learning Objective: To acquire programming skills in core Python and to develop database applications in Python

Unit I

Core Python: Introduction - Python Basics: Comments - Statements and syntax - variable Assignment - Identifiers - **Python objects:** Built-in-types - Internal types - Standard Type operators - Standard type Built-in-functions. **Numbers:** Introduction to Numbers - Integers - Floating point numbers - Complex numbers - Operators - Built-in and factory functions – Conditionals and Loops - **Sequences:** Strings, Lists and Tuples.

Unit II

Mapping and set types. - **Functions and functional programming:** Introduction - Calling functions - Creating functions - passing functions - Formal arguments - Variable - Length Arguments - Functional Programming - Variable Scope – Recursion.

Unit III

Modules: Modules and Files – namespaces - Importing Modules - Features - Built-in functions. **Object Oriented Programming:** Introduction - Object Oriented Programming – Encapsulation Inheritance – Polymorphism - **Errors and Exceptions:** Introduction – Exceptions in Python.

Unit IV

GUI Programming: Introduction – **Using Widgets:** Core widgets- Generic widget properties – Labels – Buttons – Radio Buttons – Check Buttons – Text – Entry – List Boxes – Menus – Frame – Scroll Bars – Scale.

Unit V

Database Programming: Connecting to a database using MongoDB - Creating Tables - INSERT-UPDATE - DELETE - READ operations.

Text Books:

1. Wesley J. Chun, (2007), “Core Python Programming”, Pearson Education, Second Edition – (Unit I, II, III).
2. Charles Dierbach, (2015), “Introduction to Computer Science Using Python A Computational Problem-Solving Focus”, Wiley India Edition- (Unit III- Object Oriented Programming)
3. Martin C Brown, (2018), “The Complete Reference Python”, McGraw Hill Education (India) Private Limited – (Unit IV)

Reference Books:

1. Mark Lutz, (2013), “Learning Python Powerful Object Oriented Programming”, O’reilly Media, 5 th Edition.
2. Timothy A. Budd, (2011), “Exploring Python”, Tata MCGraw Hill Education Private Limited, First Edition.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), “How to think like a computer scientist: learning with Python”.

Web References:

1. <http://interactivepython.org/courselib/static/pythonds>

2. <http://www.ibiblio.org/g2swap/byteofpython/read/>
3. <http://www.diveintopython3.net/>
4. <http://docs.python.org/3/tutorial/index.html>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Explain the basic concepts in python language.
CLO2	Apply the various data types and identify the usage of control statements, loops, functions and modules in python for processing the data
CLO3	Analyze and solve problems using basic constructs and techniques of python.
CLO4	Assess the approaches used in the development of interactive application.
CLO5	To build real time programs using python

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	2	2
CO2	3	3	3	3	3	2
CO3	3	2	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	13	15	15	13	15

CORE II-LAB: PYTHON PROGRAMMING - PRACTICAL

Code : P23IT1P1
Semester : I

Hours/Week: 7
Credits: 5

Learning Objective: This course gives practical experience in Python basics, Object Oriented programming like Classes, Inheritance, and Polymorphism, GUI Applications and Database connection.

Course Outline

1. Python Basic programs
2. Control Structures
3. Lists
4. Functions and Recursions
5. Modules
6. String Processing
7. Dictionaries and Sets
8. Classes and Objects
9. Polymorphism
10. Inheritance
10. GUI Application
11. Working with Database

Text Books:

1. Wesley J. Chun, "Core Python Programming", Pearson Education, Second Edition, 2007.

Reference Books:

1. Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reillyMedia, 5th Edn., 2013
2. Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Pvt. Ltd., First Edition. 2011.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to think like a computer scientist: learning with Python"

Web Reference Books:

1. <http://interactivepython.org/courselib/static/pythonds>
2. <http://www.ibiblio.org/g2swap/byteofpython/read/>
3. <http://www.diveintopython3.net/>
4. <http://docs.python.org/3/tutorial/index.html>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand the significance of control statements, loops and functions in creating simple programs.
CLO2	Apply the core data structures available in python to store, process and sort the data
CLO3	Analyze the real time problem using suitable python concepts
CLO4	Assess the complex problems using appropriate concepts in python
CLO5	Develop the real time applications using python programming language.

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	2	2
CO2	3	3	3	3	3	2
CO3	3	2	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	13	15	15	13	15

CORE III-LAB: WEB DEVELOPMENT USING WORD PRESS - PRACTICAL

Code: P23IT1P2

Hours/Week: 6

Semester: I

Credits: 4

Learning Objective: The primary course objective of this paper is to learn the fundamentals of basic web concepts, HTML, DHTML, JavaScript and Word Press.

Introduction to HTML - Lists - Adding Graphics to HTML Documents - Tables -Linking Documents - Frames- Developing HTML Forms

Exercises:

1. Creating ordered and unordered Lists using simple tags
2. Creating Tables
3. Creating Hyperlinks
4. Creating Frames

UNIT II

Dynamic HTML - Cascading Style Sheets - Use of SPAN Tag - External Style Sheets -Use of DIV Tag - Developing Websites

Exercises:

1. Creating Embedded style sheet
2. Use of External style sheet
3. Creating Inline style sheet

UNIT III

Introduction to JavaScript - JavaScript in Web Pages - Advantages - Writing JavaScript into HTML - Basic Programming Techniques - Operators and Expressions- JavaScript Programming Construct: Conditional Checking, Controlled Loops, Functions: Built-in Functions, User-Defined Functions - Placing Text in a Browser - Dialog Boxes.

Exercises:

1. Using Conditional checking
2. Using Looping constructs
3. Using Arrays and Functions
4. Creating Dialog Box

UNIT IV

JavaScript Document Object Model: Introduction - Understanding Objects in HTML - Handling Events using JavaScript. Forms used by a Website: Form Object - Built-in Objects.

Exercises:

1. Handling Events
2. Creating Forms
3. Form Validation for Name, E-Mail Id and Password
4. Form Validation for Date, Month and Year
5. Using Built-in Objects

UNIT V

Word Press: Installation - Stetting and administration- Word press: Theming basics - Our First Word Press Website - Theme Foundation - Menu and navigation - Home page - Dynamic Sidebars and Widgets - Page - archive Page results - Testing and Launching.

Exercises:

Case Study: Design a complete website using word press and prepare it for publishing.

Text Books:

1. Ivan N. Bayross, (2005), Web Enabled Commercial Applications Development Using HTML, DHTML, JavaScript, perICGI, 3rd Edition, BPB Publications. (Unit I, II, III and IV)
2. Jesse Friedman,(2012), Web Designer's Guide to WordPress: Plan, Theme, Build, Launch (Voices That Matter), 1st Edition , New Riders. (Unit V)

Reference Books:

1. N.P. Gopalan, J. Akilandeswari, (2009), Web Technology: A Developer's Perspective, Eastern Economy Edition, PHI Learning Private Limited.
2. Deitel&Deitel, (2000), Internet and World Wide Web How to program, Prentice Hall.
3. Jon Duckett, (2004), Beginning Web Programming with HTML, XHTML, and CSS, Wiley Publishing, Inc.

Web Reference Books:

1. http://www.sergey.com/web_course/content.html
2. <http://www.pageresource.com/jscript/index.html>
3. <http://www.peachpit.com/guides/content.aspx>
4. <https://www.tutorialspoint.com/wordpress/index.htm>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Identify the tools which will be suitable for the requirement of the webpage.
CLO2	Implement Java script and Style Sheets effectively in the Web Pages
CLO3	Analyze the different tools and built-in functions available to be applied in the webpage
CLO4	Rate the design and effectiveness of the Web Pages created.
CLO5	Design and publish a website using Word press

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	2	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PO/PSO	15	15	15	11	11	15

ELECTIVE I: DATA STRUCTURES

Code : P23IT1:A
Semester : I

Hours/Week: 5
Credits: 3

Learning Objective: To become familiar with the various data structures and their applications and to increase the understanding of basic concepts of the design and use of algorithms

UNIT I

Introduction and Overview: Definitions – Concept of Data Structures – Overview of Data Structures – Implementation of Data Structures – Arrays: Definition – One Dimensional Array – Multidimensional Arrays: Two Dimensional Array – Sparse Matrices – Three dimensional and n-dimensional Arrays – Stacks : Introduction – Definition – Representation of Stack – Operations on Stack – Applications of Stacks: Evaluation of Arithmetic Expressions – Implementation of Recursion - Tower of Hanoi Problem

UNIT II

Basic Logic Gates: Queues: Introduction – Definition – Representation of Queues – **Various Queue Structures:** Circular Queue – Deque – Priority Queue – **Applications of Queues:** Simulation – CPU Scheduling in a Multiprogramming Environment – Round Robin Algorithm – **Linked Lists:** Single Linked List – Circular Linked List – Double Linked List – Circular Double Linked List – **Applications of Linked List:** Polynomial Representation.

UNIT III

Trees: Basic Terminologies – Representation of Binary Tree: Linear Representation – Linked Representation – Operations: Traversals – Types of Binary Trees: Expression Tree – Binary Search Tree – Splay tree.

UNIT IV

Sorting: Bubble Sort, Insertion Sort, Selection Sort, Shell Sort – Quick Sort - Merge Sort - Radix Sort - Heap Sort – Searching: Linear Search - Binary Search.

UNIT V

Graphs: Introduction – Graph representation and its operations – Path Matrix – Graph Traversal - Application of DFS – Shortest Path Algorithm - Minimum Spanning Tree : Prim’s Algorithm – Kruskal’s Algorithm - Greedy – Knapsack – Back Tracking – 8 Queens.

Text Books:

1. Debasis Samantha (2013), Classic Data Structures, Second Edition, PHI Learning Private Limited.
2. P. Sudharsan, J. John Manoj Kumar, C & Data Structures, Third Edition, RBA Publications. Unit 4: Chapter 14, Unit 5: Chapter 13
3. Ellis Horowitz, SartajSahni, Sanguthevar Rajeshakaran, (2007), Fundamentals of Computer Algorithms, Second Edition, Universities Press (P) Limited.

Books for Reference:

1. Sara Baase, (1991), Computer Algorithms – Introduction to Design and Analysis, Addison-Wesley Publishing Company
2. Robert Kruse, C.L.Tondo, Bruce Leung, Data Structures and Program Design in C ,2nd Edition, PHI Publications.

Web Reference Books:

1. <http://www.cs.sunysb.edu/~skiena/214/lectures/>
2. <http://datastructures.itgo.com/graphs/dfsdfs.htm>
3. <http://oopweb.com/Algorithms/Documents/PLDS210/VolumeFrames.html>
4. <http://discuss.codechef.com/questions/48877/data-structures-and-algorithms>
5. <http://code.tutsplus.com/tutorials/algorithms-and-data-structures--cms-20437>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic data structures
CLO2	Identify the different operations and memory representations
CLO3	Interpret different techniques with their complexities
CLO4	Compare the applications of various data structures
CLO5	Choose an algorithm to solve simple problems suited for appropriate situations

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	2	2	1	2

CLO2	3	2	2	2	2	3
CLO3	3	2	3	3	3	2
CLO4	3	3	2	3	3	3
CLO5	3	3	3	3	3	2
Weightage of course contribute to each PSO	15	11	12	13	12	14

ELECTIVE I: COMPILER DESIGN

Code : P23IT1:B
Semester : I

Hours/Week: 5
Credits: 3

Learning Objective: On successful completion of the subject the students should have understood the different phases of compiler and needs of the compiler.

UNIT I

Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling

UNIT II

Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Non-deterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing.

UNIT III

Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self

Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponc mode, Case study on Lex and Yacc.

UNIT IV

Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking.

UNIT V

Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms.

Text Books:

1. Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman.

Books for Reference:

1. Dhamdhare D.M., “Compiler Construction: Theory and Practice”, McMillan India Ltd., 1983
2. Holub Allen, “Compiler Design in C”, Prentice Hall of India, 1990.

Web Reference Books:

1. <https://www.geeksforgeeks.org/compiler-design-tutorials/>
2. https://www.tutorialspoint.com/compiler_design/
3. <https://www.javatpoint.com/compiler-tutorial>
4. https://onlinecourses.nptel.ac.in/noc19_cs01/preview
5. <http://ecomputernotes.com/compiler-design>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Identify the major phases of compilation and the functionality of LEX and YACC
CLO2	Describe the functionality of compilation process and symbol table management
CLO3	Apply the various parsing, optimization techniques and error recovery routines to have a better code for code generation
CLO4	Analyze the techniques and tools needed to design and implement compilers.
CLO5	Test a compiler and experiment the knowledge of different phases in compilation

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	2	3	2

CLO2	3	2	2	2	3	3
CLO3	3	2	3	3	2	3
CLO4	3	3	3	3	2	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	12	13	13	13	14

ELECTIVE I: NATURAL LANGUAGE PROCESSING

Code : P23IT1:C
Semester : I

Hours/Week: 5
Credits: 3

Learning Objective: To impart knowledge related to the various concepts, methods of Network Security using cryptography basics, program security, database security, and security in networks.

UNIT I

Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models

UNIT III

Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature

structures

UNIT IV

Semantics and Pragmatics: Requirements for representation, FirstOrder Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods

UNIT V

Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)

Text Book:

1. Daniel Jurafsky, James H. Martin;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, OReilly 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 Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

Web Reference:

1. <http://www.cse.iitb.ac.in/~pb/papers/nlp-iitb.pdf>
2. <https://www.nitk.ac.in/faculty/dr-sarika-jain>
3. <https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp>
4. https://www.sas.com/en_us/insights/analytics/what-is-natural-language-processing-nlp.html
5. <https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language
CLO2	Identify various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parsing and semantic analysis
CLO3	Classify the text into an organized group using a set of handicraft linguistic rules with appropriate NLP processes and algorithms
CLO4	Analyze the system with various language analysis methods and interpret the results

CLO5	Assess NLP systems, identify and suggest solutions for the shortcomings
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CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	2	2	2
CLO2	3	2	2	2	2	2
CLO3	3	2	2	3	2	3
CLO4	3	2	2	3	2	3
CLO5	3	2	2	3	3	3
Weightage of course contribute to each PSO	15	10	10	13	11	13

ELECTIVE II: OPERATING SYSTEMS

Code : P23IT1:D
Semester : I

Hours/Week: 5
Credits: 3

Learning Objective To give a detailed knowledge on Data structures and to give an exposure in the development of algorithms related to data structures.

UNIT I

Introduction : Evolution of Operating System - Structure - Processes - The Process Concepts - Inter Process Communication - IPC Problems - Scheduling Levels - Preemptive Vs Non- Preemptive Scheduling - **Scheduling Algorithms:** First Come First Served - Shortest Job First - Shortest Remaining Time Next - Three Level Scheduling - Round Robin Scheduling - Priority Scheduling -Multiple Queues - Shortest Process Next - Guaranteed Scheduling - Lottery Scheduling - Fair-Share Scheduling - Thread Scheduling

UNIT II

Swapping - Virtual Memory - Page Replacement Algorithm - Segmentation

Unit III

Deadlock - Examples of Deadlock - Detection - Recovery - Avoidance - Prevention – Semaphore -Shared Memory.

Unit IV

File System - Files - Directories - I/O Management - Disks - Disk Arm Scheduling Algorithm.

Unit V

Introduction to Linux: Introducing Shell Programming - Linux File Systems - Linux File system calls - Implementation of Linux File systems - Linux Commands - Directory Oriented Commands - File Oriented Commands - Communication Oriented Commands- General Purpose Commands

Text Books

1. Andrew S. Tanenbaum, (2001), Modern Operating Systems, 2nd Edition, Prentice Hall of India.
2. B.Mohamed Ibrahim, (2005) Linux Practical Approach, Firewall Media.

References

1. Silberchatz, Galvin, Gagne, (2003), Operating Systems Concepts, 6th Edition Wiley India Edition.
2. JhonGoerzen, (2002), Linux Programming Bible, 4th Edition, Wiley- dreamtech India (P) Ltd.

Web Reference Books:

1. https://www.webopedia.com/TERM/O/operating_system.html
2. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf
3. <http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts---9th2012.12.pdf>
4. https://www.informatics.indiana.edu/rocha/academics/i101/pdfs/os_intro.pdf
5. <https://www.youtube.com/watch?v=oJMYYMIGVMU>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the fundamental concepts of an OS and their respective functionality
CLO2	Demonstrate the importance of open-source operating system commands
CLO3	Identify and stimulate management activities of operating system
CLO4	Analyze the various services provided by the operating system
CLO5	Interpret different problems related to process, scheduling, deadlock, memory and files

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	1	2	2	2
CLO2	3	2	2	3	3	2
CLO3	3	3	2	2	2	2
CLO4	3	3	3	3	2	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	12	11	13	12	12

ELECTIVE II: DIGITAL COMPUTER ARCHITECTURE

Code : P23IT1:E
Semester : I

Hours/Week: 5
Credits: 3

Learning Objective: To acquire knowledge on employing Object Oriented Analysis and Design Techniques in software designing.

UNIT - 1

Data Representation - Data Types - Number Systems - Decimal and Alphanumeric Representation - Complements (r-1)'s complement - (r's) complement - Fixed- point Representation - Floating-point Representation - Binary Codes - Gray Codes - Decimal Codes - Alphanumeric Codes – Error Detection Codes.

UNIT - 2

Digital Computers - Logic Gates - Boolean Algebra - K-Map Simplification - Combinational Circuits - Half

Adder - Full Adder - SR, D, JK and T Flip Flops - Sequential Circuits - State Table - State Diagram - Digital Components: Integrated Circuits - Decoders - NAND Gate Decoder - Encoders - Multiplexers - Registers - Shift Registers - Binary Counters - Memory Unit.

UNIT - 3

Register Transfer and Micro-operations: Register Transfer Language - Register Transfer - Bus and Memory Transfers - Arithmetic Micro-operations - Logic Micro-operations - Shift Micro- operations - Arithmetic Logic Shift Unit. Computer Organization and Programming: Instruction Codes - Computer Registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory Reference Instructions - Input-Output and Interrupt.

UNIT - 4

Central Processing Unit: General Register Organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Program Control. I/O Organization: Peripheral Devices - I/O Interface - Asynchronous Data Transfer - Modes of Transfer - Priority Interrupt – DMA.

UNIT - 5

Memory Organization and CPU: Memory Hierarchy - Main Memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual Memory - Memory Management Hardware

TEXT BOOK

1. M. Morris Mano, “Computer System Architecture”, Prentice Hall of India, 2001.

REFERENCE BOOKS:

1. John P. Hayes, “Computer Architecture and Organization”, Tata McGraw Hill, 1996.
2. V C Hamatcher et al, “Computer Organization”, Tata McGraw Hill, 1996.

Web Reference Books:

1. <http://www.labri.fr/perso/strandh/Teaching/AMP/Common/Strandh-Tutorial/Dir.html>
2. <http://www.computer-pdf.com/architecture/>
3. <http://www.uotechnology.edu.iq/depcse/lectures/3/>
4. <http://www.csie.nuk.edu.tw/~kcf/course/ComputerArchitecture/>
5. <http://www.ecs.csun.edu/~cputnam/Comp546/Putnam/Cache%20Memory.pdf>(UnitV: Cache Memory)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the fundamental concept of binary representation and codes, combinational circuits, Instruction formats, register operations and memory organization
CLO2	Explain the various types of flip flops, different types of micro operations, as well as the addressing modes in the instruction set
CLO3	Apply the various number conversion systems and simplification of equations using K-map
CLO4	Analyze the various design of combinational circuits and flip flops to design a computer

CLO5	Distinguish the major components of a computer including CPU, memory, I/O and storage
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CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	1	2	2	2
CLO2	3	2	2	2	2	2
CLO3	2	2	2	2	2	2
CLO4	3	2	2	2	3	2
CLO5	3	2	3	2	3	3
Weightage of course contribute to each PSO	14	10	10	10	12	11

ELECTIVE II: HUMAN COMPUTER INTERACTION

Code : P23IT1:F

Hours/Week: 5

Semester : I

Credits: 3

Learning Objective:

To think constructively and analytically in designing and evaluating interactive technologies.

UNIT-I :

Foundations: The Human: Introduction-Input-Output Channels- Memory. The Computer: Introduction- Text Entry Devices- Display Devices- Memory. The Interaction: Introduction – Models of Interaction-Frameworks and HCI Ergonomics-Interaction Styles-Elements of the WIMP Interface-Interactivity - The Context of the Interactions

UNIT-II :

Design Process: Design Basics- Introduction - Process- User Focus-Scenarios- Navigation Design- Screen Design and Layout-Interaction and Prototyping. Design Rules-Introduction- Principles to Support Usability-Guidelines-Golden Rules and Heuristics-HCI Patterns.

UNIT-III :

Implementation Support: Introduction - Elements of Windowing Systems - Programming the Application- Using Toolkits-User Interface Management Systems. Evaluation Techniques: What is an Evaluation- Goal of Evaluation-Evaluation Through Expert Analysis-Choosing an Evaluation Methods.

UNIT-IV :

Universal Design: Introduction - Universal Design Principles-Designing for Diversity. User Support: Introduction-Requirements of User Support-Approaches to User Support-Adaptive Help Systems-Designing User Support Systems.

UNIT-V:

Models: Cognitive Models: Introduction-Goals and Task-Linguistic Models- Challenge of Display Based System-Physical and Device Models - Cognitive Architectures

TEXT BOOK

1. Alan dix, Janet finlay, Gregory D. Abowd and Russell Beale,(2004),Human Computer Interaction, 3rd edition, Pearson Education.

REFERENCE BOOKS:

1. John C. Carroll, (2002), Human Computer Interaction in the new millennium, Pearson Education
2. Jenny Preece, Yvonne Rogers, Helen Sharp (2019), Interaction Design: Beyond Human–Computer Interaction,fifth edition, John Wiley & Sons Inc.

Web Reference Books:

1. <http://courses.iicm.tugraz.at/hci/>
2. <http://www.hcibook.com/hcibook/downloads/pdf/exercises.pdf>
3. <http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lectures.html>
4. <http://user.medunigraz.at/andreas.holzinger/holzinger/papersen/HCI/Workshop/forISSEP%202005.pdf>
5. <http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/> (Unit IV: Universal Design Principles)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms
CLO2	Identify the usability and the beneficiary factors of User support systems
CLO3	Analyze the core theories, models and methodologies in the field of HCI
CLO4	Evaluate interactive systems based on the human factor theories
CLO5	Elaborate an interactive system based on the design principles, standards and guidelines

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	1	2	2	2
CLO2	3	2	1	2	2	2
CLO3	3	2	2	3	3	3
CLO4	3	3	2	3	3	3
CLO5	3	2	2	3	3	3
Weightage of course contribute to each PSO	15	11	8	13	13	13

CORE- IV: RELATIONAL DATABASE MANAGEMENT SYSTEMS

Code : P23IT202

Hours/Week: 6

Semester : II

Credits: 5

Learning Objective: To understand the basic DBMS models, architecture, query and to normalize the database. To Learn Transaction Processing, Recovery and Distributed Database.

Unit I

Introduction: Database System Applications-Purpose of Database Systems-View of Data- Database Users and Administrators. **Relational Database:** Structure of Relational Databases- Databases Schema- Keys-Schema Diagrams-**Formal Relational Query Languages:** Relational Algebra-Tuple Relational Calculus.

Unit II

Database Design: Overview of Design Process-The Entity Relationship Model-Constraints- Removing Redundant Attributes in Entity Sets-Entity-Relationship Diagrams-Reduction to Relational Schemas-Extended E-R features -Alternative Notations for Modeling Data. **Relational Database Design:** Features of Good Relational Design-Functional Dependency- **Normalization:** 1NF, 2NF, 3NF, BCNF, 4NF, 5NF-Functional Dependency Theory.

Unit III

Transaction Management: Transaction Concept-Simple Transaction Model-Storage Structure- Transaction Atomicity and Durability-Transaction Isolation-Serializability. **Concurrency Control:** Lock Based Protocols-Locks-Granting of Locks-Two Phase Locking Protocol-Time Stamp Based Protocol - **Recovery System:** Failure Classification-**Recovery and Atomicity:** Log Records-Database Modification-Concurrency Control and Recovery-Recovery Algorithm.

Unit IV

Distributed Database: Homogeneous and Heterogeneous Databases-Distributed Data storage- Distributed Transactions-Commit Protocols-Concurrency Control in Distributed Databases- Distributed Query Processing. Case study: MongoDB

Unit V

SQL - Table Fundamentals - Viewing Data - Inserting - Deleting - Updating - Modifying - Constraints - Functions - Grouping - Subqueries - Joins - Views. **PL/SQL:** Introduction - PL/SQL Block - Data Types And Variables - Control Structure - Cursors - PL/SQL Security - Locks. PL/SQL Database Objects: Exception Handling- Packages - Procedures and Functions - Database Triggers.

Text Books:

1. Abraham Silberchatz, Henry F.Korth, S.Sudarshan, Database Systems Concepts, Sixth Edition, Tata Mcgraw Hill.
2. Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPB Publications. Unit IV & V

Reference Books:

1. AtulKahate, Introduction to Database Management systems, Pearson education.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, (1997), Advanced Database Systems, Morgan Kaufman.
3. George Koch, Kelvin Loney, (2002), Oracle 9i : The Complete Reference, Oracle Press, Tata McGrawHill Publication.
4. RamezElmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, Pearson Education, New Delhi

Web References:

1. <http://awtrey.com/tutorials/dbeweb/database.php>
2. <http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia-database>.
3. <http://www.tutorialspoint.com/dbms/index.htm>
4. <http://www.tutorialspoint.com/plsql/index.htm>
5. <https://opentextbc.ca/dbdesign/chapter/chapter-11-functional-dependencies/> (Functional Dependencies)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Explain the relational databases and uses of PL/SQL
CLO2	Apply Schema, ER- Model, normalization, transaction, concurrency, and recovery on tables using SQL and PL/SQL.
CLO3	Analyze and manage relational & distributed, database, transaction, concurrency control and query languages
CLO4	Assess databases based on models and Normal Forms.
CLO5	Design and construct tables and manipulate it effectively using PL/SQL database objects

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	3	3
CLO2	3	3	3	3	3	2
CLO3	3	2	3	3	3	2
CLO4	3	3	3	3	3	2
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	13	15	15	15	12

CORE V-LAB: RDBMS-PRACTICAL

Code : P23IT2P3
Semester : II

Hours/Week: 6
Credits: 5

Learning Objective: The primary Course Objective of this paper is to learn and implement SQL & PL/SQL.

Course Outline

1. DDL Commands
2. DML Commands
3. DCL Commands
4. Usage of Sub Queries in DML and Create-SQL
5. Solving queries using built-in functions
6. Simple programs in PL/SQL block

7. Exception Handling in PL/SQL
8. Programs using Implicit Cursors
9. Programs using Explicit Cursors
10. Procedures & User-defined functions
11. Creation of Triggers

Text Books:

Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPB Publications.

Reference Books:

RamezElmasri, Shamkant B. Navathe (2014), “Database Systems”, Sixth edition, Pearson Education, New Delhi

Web References:

1. <http://awtrey.com/tutorials/dbeweb/database.php>
2. <http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia-database>.
3. <http://www.tutorialspoint.com/dbms/index.htm>
4. <http://www.tutorialspoint.com/plsql/index.htm>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Choose appropriate SQL queries and PL/SQL blocks for the database.
CLO2	Implement SQL and PL/SQL blocks for the given problem effectively.
CLO3	Analyse the problem and Exceptions using queries and PL/SQL blocks.
CLO4	Validate the database for normalization using SQL and PL/SQL blocks.
CLO5	Design Database tables, create Procedures, user-defined functions and Triggers.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	2	3	3	3
CLO2	3	3	3	3	3	3
CLO3	3	3	2	3	3	3
CLO4	3	3	2	3	3	2
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	15	12	15	15	14

CORE VI - LAB: OPEN-SOURCE TECHNOLOGIES- PRACTICAL

Code : P23IT2P4
Semester : II

Hours/Week: 6
Credits: 4

Learning Objective: To learn the efficiency of Open-Source Technology and to train to have a good practical knowledge of how to write successful PHP and Ruby code and utilizing a database using PHP.

UNIT-I :

PHP: Introduction – Creating a PHP page – Running PHP page –HTML and PHP – Printing Text – Comment Statements – Working with variables – Storing data in variables - Interpolating strings – Constants - Understanding Internal Datatypes – Operators – Flow Control – Strings: String Functions - Converting to and

from strings - Formatting text strings - Working with numbers.

UNIT II

Date and Time - Create an Array - Use an Associative Array - Functions to Work with Arrays -Work with Arrays of Arrays - Create and Use Functions

UNIT III

Reading Data in web pages: Handling various controls - PHP Browser-Handling power: Data Validation - File Handling: Opening a file – Reading Text from a file – Closing a file- Working with Databases: Creating, Inserting, Accessing, Updating, Deleting and Sorting Database - Work with Cookies and Sessions.

UNIT IV

Ruby: Getting Started with Ruby – Working with Numbers and Strings – Variables – Constants – Operators – Conditionals and Loops.

UNIT V

Arrays - Hashes - Methods - Blocks: Classes and Objects: Creating a Class and an Object-Exception Handling – File Handling.

Text Books:

1. Steven Holzner, (2016), “PHP: The Complete Reference”, McGraw Hill Education Private Limited, Indian Edition. (Unit I, II)
2. Rachna Kapur, Mario Briggs, Tapas Saha, Ulisses Costa, Pedro Carvalho, Raul F. Chong, Peter Kohlmann (2010), “Getting Started with Open-Source Development”, DB2 on Campus Book Series. (Unit III)
3. <http://indexof.es/Ruby/Beginning%20Ruby%20On%20Rails.pdf> (Unit IV)
4. <http://www.cs.uni.edu/~wallingf/teaching/agile-may2010/ruby/programming-ruby.pdf>(Unit V)

Reference Books

1. W. Jason Gilmore (2010), “Beginning PHP & MySQL”, Apress.
2. Joel Murach, Ray Harris (2010), “PHP and MySQL”, Shroff Publishers & Distributors
3. Larry Ullman (2008), “PHP 6 and MySQL 5”, Pearson Education.
4. John Coggeshall (2006), “PHP 5”, Pearson Education.
5. Michale C. Glass (2004), “Beginning PHP, Apache, MySQL Web Development”, Wiley DreamTech Press.

Web References

1. <http://www.w3schools.com/php/>
2. <http://howtostartprogramming.com/PHP/>
3. <http://www.massey.ac.nz/~nhreyes/MASSEY/159339/Lectures/Lecture%2011%20-%20PHP%20-%20Part%205%20-%20CookiesSessions.pdf>
4. <http://www.tutorialspoint.com/mysql/>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the setup and configuration of development environment to write PHP and Ruby Scripts

CLO2	Select the appropriate language fundamentals and techniques to write and compile PHP and Ruby programs
CLO3	Examine the bugs and analyze how to prevent and remove the bugs
CLO4	Test and debug the application with sample inputs to check the correctness and consistency of the scripts
CLO5	Create simple programs that make use of various PHP and Ruby features and functions and solve web application and database tasks using PHP

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	1	2	3
CLO2	3	3	3	2	2	2
CLO3	3	2	3	3	2	2
CLO4	3	2	3	2	3	3
CLO5	3	3	3	3	2	3
Weightage of course contribute to each PSO	15	13	15	11	11	13

ELECTIVE III: BIOMETRIC TECHNIQUES

Code : P23IT2:A

Hours/Week: 4

Semester : II

Credits: 3

Learning Objective: To understand various physiological and behavioural biometrics and its applications.

UNIT I

Introduction: Biometric Fundamentals - Biometrics Vs Traditional Techniques - Benefits of Biometrics in Identification Systems - Key Biometric Terms and Processes: Verification, Identification and Biometric Matching - Accuracy in Biometric Systems: False Match Rate, False Non-Match Rate, Failure to Enroll Rate, Derived Metrics

UNIT II

Physiological Biometrics: Finger Scan: Components-How it works-Competing Technologies- Deployments-Strengths and Weaknesses. Facial Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses.

UNIT III

Other Physiological Biometrics: Iris Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Voice Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Other Physiological Biometrics: Hand Scan and Retina Scan.

UNIT IV

Behavioural Biometrics: Signature Scan and Keystroke Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Esoteric Biometrics: Vein Pattern- Facial Thermography-DNA- Sweat Pores- Hand Grip- Finger Nail Bed- Body Odor- Ear-Gait- Skin Luminescence- Brain Wave Pattern- Foot Print and Foot Dynamics.

UNIT V

Biometric Applications: Categorizing Biometric Applications - Application Areas: Criminal and Citizen Identification, Surveillance, PC/Network Access, E-Commerce/Telephony and Retail/ATM - Costs to Deploy - Issues in Deployment- Biometric Standards.

TEXT BOOKS:

1. Samir Nanavati, Michael Thieme, Raj Nanavati,(2003),Biometrics - Identity Verification in a Networked World, Wiley-dreamtech India Pvt Ltd, New Delhi
2. John D. Woodward, Nicholas M. Orlans, Peter T. Higgins, Biometrics: the ultimate reference, Dreamtech Press.

REFERENCES:

1. Anil K Jain, Patrick Flynn, Arun A Ross, (2008), Handbook of Biometrics, Springer.

Web References

1. <http://www.sans.org/reading-room/whitepapers/authentication/biometric-scanning/>
2. <http://www.biometrics.gov/documents/biointro.pdf>
3. <http://www.cse.unr.edu/~bebis/CS790Q/Lect/IntroBiometrics.pdf>
4. http://www.planetbiometrics.com/creo_files/upload/article-files/btamv011 update.pdf
5. <http://www.biometrics.gov/documents/biointro.pdf> (Unit V: Biometric Applications)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the existing theories, methods and interpretations in the field of biometrics
CLO2	Identify the deployment areas, competing technologies, strength and weakness of various Physiological and Behavioral Biometrics
CLO3	Analyze various Application areas, Biometric security issues and Biometric standards
CLO4	Assess the methods relevant for design, development and operation of biometric access control systems
CLO5	Determine identification /verification systems to validate the user identity and technological uplifts in biometrics compared to traditional securing mechanisms

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	2	1	1	1	1	1
CLO2	2	2	1	1	2	2
CLO3	3	2	1	2	2	3
CLO4	3	2	2	3	3	2
CLO5	3	3	2	3	3	3
Weightage of course contribute to eachPSO	13	10	7	10	11	11

ELECTIVE III: DIGITAL WATERMARKING AND STEGANOGRAPHY

Code : P23IT2:B
Semester : II

Hours/Week: 4
Credits: 3

Learning Objective To learn about the watermarking models and message coding and learn about watermark security and authentication and also about steganography. Perceptual models

COURSE OUTCOMES: After the successful completion of this course, the student will be able to

CO1 :	[K2]	Understand the concepts of information hiding, steganography, and watermarking.
CO2 :	[K3]	Interpret Receiver Operating Characteristic (ROC) curves and evaluate their impact on watermarking performance.
CO3 :	[K4]	Evaluate the perceptual impact of watermarking on multimedia content.
CO4 :	[K5]	Implement exact authentication and selective authentication techniques.
CO5 :	[K6]	Apply practical steganographic methods for hiding information in various media.

UNIT - I

Introduction: Information Hiding, Steganography and Watermarking – History of watermarking – Importance of digital watermarking – Applications – Properties – Evaluating watermarking systems. **Watermarking models & message coding:** Notation – Communications – Communication based models – Geometric models – Mapping messages into message vectors – Error correction coding – Detecting multi-symbol watermarks.

UNIT - II

Watermarking with side information & analyzing errors: Informed Embedding – Informed Coding – Structured dirty-paper codes - Message errors – False positive errors – False negative errors – ROC curves – Effect of whitening on error rates.

UNIT - III

Perceptual models: Evaluating perceptual impact – General form of a perceptual model – examples of perceptual models – Robust watermarking approaches - Redundant Embedding, Spread Spectrum Coding, Embedding in Perceptually significant coefficients

UNIT - IV

Watermark security & authentication: Security requirements – Watermark security and cryptography – Attacks – Exact authentication – Selective authentication – Localization – Restoration.

UNIT - V

Steganography: Steganography communication – Notation and terminology – Information- theoretic foundations of steganography – Practical steganographic methods – Minimizing the embedding impact – Steganalysis

References

1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, “Digital Watermarking and Steganography”, Morgan Kaufmann Publishers, New York, 2008.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, “Digital Watermarking”, Morgan Kaufmann Publishers, New York, 2003.
3. Michael Arnold, Martin Schmucker, Stephen D. Wolthusen, “Techniques and Applications of Digital Watermarking and Content Protection”, Artech House, London, 2003.

ELECTIVE III: DIGITAL IMAGE PROCESSING

Code : P23IT2:C

Semester : II

Hours/Week: 4

Credits: 3

Learning Objective: To study the various concepts, methods and algorithms of digital image processing with image transformation, image enhancement, image restoration, image compression techniques.

Course Outcomes: On successful completion of this course, the students will be able to:

CO1 :	[K2]	Understand continuous and Discrete images, different types of transformation and sampling techniques in image processing.
CO2 :	[K3]	Use images in the frequency domain using various transforms and decomposition
CO3 :	[K4]	Inspect different techniques employed for the enhancement of images.
CO4 :	[K5]	Propose causes for image degradation and overview of image restoration techniques.
CO5 :	[K6]	Discuss the need for image compression and to learn the spatial and frequency domain techniques of image compression and reconstruction.

UNIT I :

Continuous And Discrete Images And Systems: Light, Luminance, Brightness and Contrast, Eye, The Monochrome Vision Model, Image Processing Problems and Applications, Vision Camera, Digital Processing System, 2-D Sampling Theory, Aliasing, Image Quantization, Lloyd Max Quantizer, Dither, Color Images, Linear Systems And Shift Invariance, Fourier Transform, Z Transform, Matrix Theory Results, Block Matrices and Kronecker Products.

UNIT II

Image Transforms : 2-D orthogonal and Unitary transforms, 1-D and 2-DDFT, Cosine, Sine, Walsh, Hadamard, Haar, Slant, Karhunen-loeve, Singular value Decomposition transforms.

UNIT III

Image Enhancement : Point operations - contrast stretching, clipping and thresholding density slicing, Histogram equalization, modification and specification, spatial operations - spatial averaging, low pass, high pass, bandpass filtering, direction smoothing, medium filtering, generalized cepstrum and homomorphic filtering, edge enhancement using 2-D IIR and FIR filters, color image enhancement.

Unit IV

Image Observation Models, sources of degradation, inverse and Wiener filtering, geometric mean filter, nonlinear filters, smoothing splines and interpolation, constrained least squares restoration.

Unit V

Image Data Compression And Image Reconstruction From Projections: Image data rates, pixel coding, predictive techniques transform coding and vector DPCM, Block truncation coding, wavelet transform coding of images, color image coding. Random transform, back projection operator, inverse random transform, back projection algorithm, fan beam and algebraic restoration techniques.

Book for study:

1. Bernd Jähne, Digital Image Processing, Springer, 2013
2. Anil K. Jain, "Fundamentals of Digital Image Processing", PHI, 1995.
3. Sid Ahmed M.A., "Image Processing", McGraw Hill Inc, 1995.
4. Gonzalez R. and Wintz P., "Digital Image Processing", Addison Wesley, 2ndEd, 1987

ELECTIVE IV: SOFTWARE ENGINEERING

Code : P23IT2:D

Semester : II

Hours/Week: 4

Credits: 3

Learning Objective: This paper familiarizes the students with the knowledge of basic Software engineering methods and practices and gives hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

UNIT I

Introduction: A Generic View of Process - Process Models: The Waterfall Model-Incremental Model-Evolutionary Model-Specialized Model-The Unified Process-Agile Process - Agile process Models

Exercise:

Choose any one project and do the following exercises for the chosen project

- a. Student Result Management System
- b. Library management system
- c. Online course reservation system
- d. Railway reservation system
- e. Recruitment system
- f. Stock Maintenance System

Write the Problem Statement for a suggested system of relevance.

UNIT II

System Engineering: System Engineering Hierarchy - System Modelling - Requirements Engineering: Tasks-Initiating the Process-Eliciting Requirements-Developing Use Cases- Negotiating Requirements-Validating Requirements - Building the Analysis Models: Data modelling concepts - Scenario based - Flow oriented - Class based Modelling

Exercise: Preparation of Software Requirement Specification Document.

UNIT III

Design Engineering: Design Concepts - Design Models - Pattern Based Design - Architectural Design - Component Level Design: Component - Class Based and Conventional Components Design - User Interface Design: Analysis and Design

Exercise: Draw DFD and Use Case diagram for the chosen project using any CASE tools.

UNIT IV

Testing Strategies: Software Testing - Strategies: Conventional - Object Oriented - Validation Testing - System Testing: Recovery - Security - Stress - Performance - Testing Tactics: Testing Fundamentals- Black Box - White Box - Basis Path-Control Structure

Exercise: Develop test cases and perform various testing using any one of the testing tools.

UNIT V

Estimation: Software project Estimation - Empirical Estimation models - Risk management: Software Risks - Risk Identification - Risk Projection - Risk Mitigation, Monitoring and Management - Quality Management: Quality Concepts - Quality Assurance -Software Reliability- Quality Standards. Case Study: Devops Tools

Exercise: Perform Estimation of effort using FP Estimation for chosen system and prepare Gantt Chart/PERT Chart for the same.

TEXT BOOKS:

1. Roger Pressman.S., "Software Engineering: A Practitioner's Approach", 6th Edition, Mcgraw Hill, 2005.

REFERENCES:

1. Richard Failey, "Software Engineering Concepts", Tata McGraw-Hill, 2004.

2. P. Fleeger, "Software Engineering", Prentice Hall, 1999.
3. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall Of India 1991.
4. Sommerville, "Software Engineering" 5th Edition: Addison Wesley, 1996.

Web References

1. <http://productdevelop.blogspot.in/2011/03/what-are-formal-technical-reviews-ftp.html>
2. <http://basicqafundamentals.blogspot.in/2011/03/difference-between-alpha-testing-beta.html>
3. <https://www.wiziq.com/tutorials/software-engineering>
4. <http://www.jkinfoline.com/software-engineering.html>
5. <http://www.freetutes.com/systemanalysis/>
6. <http://www.softwaretestingstuff.com/2007/09/white-box-testing.html> (Unit IV: White Box Testing)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Recognize the software process models including the specification, design, implementation, and testing for a software project
CLO2	Use recent and advanced tools necessary for software project development, testing, management and reuse
CLO3	Compare and contrast various design, testing and quality issues
CLO4	Prioritize the requirements and risk accordingly that meet user expected performance, maintenance and quality
CLO5	Design software projects with well-defined architecture, modules, components and interfaces

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	3	3	2
CLO2	3	2	2	3	3	2
CLO3	3	2	3	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to each PSO	15	12	12	13	15	13

ELECTIVE IV: OBJECT ORIENTED ANALYSIS AND DESIGN

Code : P23IT2:E

Hours/Week: 4

Semester : II

Credits: 3

Learning Objectives:

The primary objective is to understand the principles & requirements and apply the UML (Unified Modeling Language) and tools for OOA and Design.

UNIT - 1

Object Basics : Object- oriented Philosophy – Object – Object State, Behaviours and Methods. Encapsulation and Information Hiding – Class Hierarchy – Polymorphism, Aggregation, Object Containment, Meta Classes.

UNIT - 2

Object Oriented Methodologies: Rumbaugh Object Model, Booch Methodology- Jacobson Methodology, Patterns, Frameworks and Unified Approach.

UNIT - 3

Object Oriented Analysis: Business Object Analysis– Use Case Driven Approach – Use Case Model. Object Analysis – Noun Phrase Approach – CRC – Identifying Object Relationships and Methods.

UNIT - 4

Object Oriented Design: The Design Process – Design Axioms – Corollaries – Design Patterns – Designing Classes. Software Quality: Tests- Testing Strategies – Test Cases – Test Plan – Continuous Testing – Mier's Debugging Principles.

UNIT - 5

UML and Programming: Introduction – State and Dynamic Models – UML Diagrams – Class Diagrams – Use Case Diagrams- UML Dynamic Modeling.

Text Book(s):

1. Ali Brahami, Object Oriented Systems Development, Tata-McGraw Hill, New Delhi.

Reference Books:

1. Martin Fowler, Kendall Scott, UML Distilled- Applying the Standard Object Modeling Language, Addition Wesley.
2. Grady Booch, (1994), Object-oriented Analysis and Design with applications, 2nd Edition, Addition Wesley.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Recognize the concepts and principles of object-oriented analysis, design and Testing
CLO2	Demonstrate the importance of system development process using various approaches and choose the relevant technique for a system in each phases of SDLC
CLO3	Differentiate various object-oriented analysis, design and testing methods and models.
CLO4	Assess various analysis, design and testing strategies appropriate to build high-performance object-oriented system
CLO5	Design Object oriented systems using object modeling techniques and analyze them for correctness and quality

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	3	2	2
CLO2	3	2	2	3	2	3
CLO3	3	3	2	3	2	3
CLO4	3	2	2	3	2	3
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	11	11	15	11	14

ELECTIVE IV: SOFTWARE PROJECT MANAGEMENT

Code : P23IT2:F

Semester : II

Hours/Week: 4

Credits: 3

Learning Objective: The primary objective is to define and highlight importance of software project management and to become familiarize in formulating software management metrics & strategy in managing projects

UNIT - 1

Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.

UNIT - 2

Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.

UNIT - 3

Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.

UNIT - 4

Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling

UNIT - 5

Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling

TEXT BOOK:

1. Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002

REFERENCE BOOK:

1. Pankaj Jalote, “Software Project Management in Practice”, Addison Wesley 2002.
2. Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition.

Web References

1. <https://highereducation.com/sites/0077109899/information-center-view/>
2. https://www.tutorialspoint.com/software_engineering/software_project_management.htm
3. <https://www.smartsheet.com/content/software-project-management>
4. https://www.philadelphia.edu.jo/academics/lalqoran/uploads/SPM_Chapter_1-%202016%204.ppt
5. <https://cs.gmu.edu/~kdobolyi/cs421/projectmanagement.ppt>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding of project management fundamentals such as project planning, risk management and quality assurance
CLO2	Choose the appropriate scheduling and testing techniques to build a quality product
CLO3	Apply different cost estimation techniques and quality measures for software development
CLO4	Differentiate various software development models and methodologies, planning activities and scheduling methods
CLO5	Asses the importance of software project documentation and identify the methods to create project documentation, including requirements documents, design documents, and project plans

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	3	3	2
CLO2	3	2	2	3	3	2
CLO3	3	2	3	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to eachPSO	15	12	12	13	15	13

NMEC I: WEB CONCEPTS

Code : P23IT2E1

Semester : II

Hours/Week: 4

Credits: 2

Learning Objectives:

To impart basic understanding of Internet and Web Content Creation using HTML and DHTML.

UNIT – 1

Introduction to the Internet : Computers in Business – Networking – Internet – Email – Resource sharing – Gopher – World Wide Web – Usenet – Telnet – Bulletin Board Service - **Internet Technologies :** Modem – Internet Addressing – Physical Connections – Telephone Lines – **Internet Browsers :** Internet Explorer – Netscape Navigator.

UNIT – 2

Introduction to HTML : History of HTML – HTML generations – HTML Documents – Anchor Tag – Hyperlinks – **Head and Body Sections :** Header Section – Title – Prologue – Links – Colorful Web Page – Comments – Sample HTML Documents.

UNIT – 3

Designing the Body Section : Heading Printing – Aligning the Headings – Horizontal Rule – Paragraph – Tab Settings – Images and Pictures – Embedding PNG Format Images – **Ordered and Unordered Lists :** Lists – Unordered Lists – Headings in a List – Ordered Lists – Nested Lists – **Table Handling :** Tables – Table Creation in HTML – Width of the Table and Cells – Cells Spanning Multiple Rows / Columns – Coloring Cells – Column Specifications – Some Sample Tables.

UNIT – 4

DHTML and Style Sheets : - Defining Styles – Elements of Styles – Linking of Style Sheet to a HTML Document – Inline Styles – External Style Sheets – Internal Style Sheets – Multiple Styles – **Frames :** Frameset Definition – Nested Framesets.

UNIT – 5

Web Page Design Project : Frameset Definition – Example Projects – **Forms :** Action Attribute – Method Attribute – Enctype Attribute – Drop down list – Sample Forms.

Text Book(s):

1. Xavier C., *“World Wide Web Design with HTML”*, TMH Publishing Company, New Delhi, 2006.

Reference Books:

1. Horton, Sarah and Quesenbery, Whitney. *A Web for Everyone*, Rosenfeld Media, 2012.
2. Yonaitis, Robert B. *Understanding Accessibility*, HiSoftware Publishing, 2002.

Web References

1. https://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm
2. <https://www.upi.pr.it/docs/easfg/easvrfp9.htm>
3. <https://www.javascript.com/>
4. https://developer.mozilla.org/en-US/docs/Web/Guide/Introduction_to_Web_development

After the successful completion of this course, the student will be able to

CLO. No.	COURSE OUTCOMES	Level	Unit
CLO1	Understand the fundamental concepts of the Internet and its role in business.	K2	I
CLO2	Create HTML documents and understand the structure of anchor tags and hyperlinks.	K3	II
CLO3	Develop tables in HTML, specifying width, coloring cells, and handling cell spans.	K3	III

CLO4	Understand the basics of frames and nested framesets.	K4	III
CLO5	Complete web page design projects using framesets and forms.	K5	IV

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	2	2	2	2
CLO2	3	3	2	3	3	2
CLO3	3	2	3	2	3	3
CLO4	3	2	3	2	3	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	13	13	12	14	13

CORE VII: ADVANCED JAVA

Code : P23IT303
Semester : III

Hours/Week: 6
Credits: 5

Learning Objective: To understand the basic concepts of core principles of the Java language and gain knowledge to develop dynamic Web applications using applet, servlet, jsp and JavaBean.

UNIT I

The Genesis of Java: Java's Magic, The Java Buzzwords-An Overview of Java - Data types, Variables, Arrays- Operators-Control Statements- Introducing Classes – A Close Look at Methods and Classes-Inheritance.

UNIT II

String Handling Functions – Collections Framework: Collection Classes, String Tokenizer, Date, Calendar - Abstract Classes - Packages and Interfaces: Packages – Access Protection Importing Packages – Interfaces.

UNIT III

Exception Handling: Exception types – Creating your own exceptions - Multithreaded Programming: Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication, Suspending, Resuming and Stopping Threads - JDBC.

UNIT IV

The Applet Class-Event Handling – Introducing the AWT: Working with windows, graphics and Text, Using AWT Controls, Layout Managers and Controls - Developing JavaServer Pages.

UNIT V

Developing Servlets -Structuring Web application with the MVC pattern – Sessions and Cookies - Using JSP tags with JavaBeans.

Text Books:

1. Herbert Schildt, (2004), “Java 2: The Complete Reference”, Fifth Edition, Tata McGraw Hill, New Delhi.
2. Joel Murach, (2008), “Andrea Steelman,,Murach's Java Servlets and JSP”, Second Edition, Shroff Publishers

Reference Books:

1. Matthew Mac Donald, (2002), “ASP.NET : The Complete Reference”, MC Graw Hill.
2. VladaMatena, (2003), “Applying Enterprise JavaBeans”, Second Edition, Addison Wesley.
3. Cay S Horstmann& Gary Cornell, Core Java Vol II Advanced Features, Eighth Edition, Addison Wesley.
4. Bruce W Perry (2004), Java Servlets & JSP Cook Book, Second edition, O'reilly Media.

Web References:

1. <http://netbeans.org/kb/docs/javaee/javaee-intro.html>
2. <http://www.jsptube.com/>
3. <http://articles.sitepoint.com/article/java-servlets-1>
4. <http://www.java-tips.org/java-tutorials/tutorials/introduction-to-java-servlets-with-netbeans.html>
5. <http://download.oracle.com/javase/tutorial/javabeans/index.html>
6. <http://www.javapoint.com/steps-to-connect-to-the-datadase-in-java/> (Unit III: JDBC)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand and explain programming language constructs, Java mechanisms, OOP and Internet programming concepts
CLO2	Apply logical constructs as well as include Object oriented features, Packages, Interfaces, Exceptions and Threads , JDBC, Internet programming technologies
CLO3	Compare and contrast classical and advanced Java in terms of features, architecture, platform and technologies
CLO4	Choose an approach to solve real world problem from the acquired knowledge of Java
CLO5	Create programs that make strong use of classes and objects and develop JDBC,GUI, Web and Enterprise based applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	2	2	2	2
CLO2	3	3	2	3	3	2
CLO3	3	2	3	2	3	3
CLO4	3	2	3	2	3	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	13	13	12	14	13

CORE VIII-LAB: ADVANCED JAVA – PRACTICAL

Code : P23IT3P5

Semester : III

Hours/Week: 6

Credits: 5

Learning Objective: This course gives practical training in basics and advanced Javaprogramming like applet, Servlets, JSP and Java Beans

Exercises:

1. Classes and objects
2. Implementing classes
3. Strings
4. Collection
5. Date and Calendar
6. Packages
7. Exception handling
8. Threads
9. JDBC
10. Applets
11. Event handling

Servlet

1. Simple Web Applications
2. Using Sessions and Cookies
3. Forwarding requests and Redirecting responses
4. Web Applications using Database

Bean

1. Developing Simple Beans
2. Use Beans with JSP tags

Text Books:

1. Herbert Schildt, (2004), “Java 2: The Complete Reference”, Fifth Edition, Tata McGraw Hill, New Delhi.
2. Joel Murach, (2008), “Andrea Steelman,,Murach’s Java Servlets and JSP”, Second Edition, Shroff Publishers

Reference Books:

1. Bruce W Perry (2004), Java Servlets & JSP Cook Book, Second edition, O’reilly Media.

Web References:

1. <http://netbeans.org/kb/docs/javaee/javaee-intro.html>
2. <http://www.jsptube.com/>
3. <http://articles.sitepoint.com/article/java-servlets-1>
4. <http://www.java-tips.org/java-tutorials/tutorials/introduction-to-java-servlets-with-netbeans.html>
5. <http://download.oracle.com/javase/tutorial/javabeans/index.html>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate understanding and use of different Java mechanisms for efficient application development

CLO2	Use an appropriate development environment to write, compile and run Java Programs
CLO3	Analyze the problem and apply the appropriate problem solving method with the required building blocks and mechanisms of Core and Advanced Java
CLO4	Test the correctness and consistency of the Java program with different inputs
CLO5	Create simple applications that make use of core java concepts and developJDBC, GUI, Web and Enterprise based applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	3	3
CLO2	3	3	3	3	2	2
CLO3	3	3	3	3	2	3
CLO4	3	3	3	2	3	3
CLO5	3	3	2	3	3	3
Weightage of course contribute to each PSO	15	15	14	14	13	14

CORE IX-LAB: MOBILE APPLICATION DEVELOPMENT- PRACTICAL

Code : P23IT3P6
Semester : III

Hours/Week: 6
Credits: 5

Learning Objective: To provide the students with the basics of Android Software Development tools, development of software on mobile platforms and deploying software to mobile devices.

UNIT I

Getting Started with Android Programming – Using Eclipse for Android Development – Using Android Emulator - Getting to know the Android User Interface: Understanding the Components of a Screen

UNIT II

Designing your User Interface with views: Basic Views – Picker Views – List Views - Displaying Pictures

Unit III

Activities, Fragments and Intents : Understanding Activities – Applying Styles and Themes to an Activity – Displaying a Dialog Window – Displaying a Progress Dialog – Linking Activities Using Intents – Fragments.

Unit IV

Menus with Views: Option Menu – Context Menu. Utilizing the Action Bar: Adding Action Items to the Action Bar – Customizing the Action Items and Application Icon -Working with Audio and Video.

Unit V

Messaging: SMS Messaging – Sending E- Mail- Data Persistence: Creating and Using Databases – Developing Android Services – Publishing Android Applications.

Text Book:

1. Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.

Reference Books:

1. OnurCinar, (2012), Android Apps with Eclipse, Apress, Springer(India) Private Limited.
2. RetoMeier, (2010), Professional Android 2 Application Development, Wiley India Edition.

Web References:

1. <http://developer.android.com/training/basics/firstapp/index.html>
2. www.vogella.com/articles/Android/article.html
3. www.coreservlets.com/android-tutorial/
4. www.edumobile.org/android/category/android-beginner-tutorial
5. <http://www.androidhive.info/2011/11/android-sqlite-database-tutorial/> (Unit V: Ex. No.3 (SQLite Database))

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the setup and configuration of Android Development Environment.
CLO2	Apply the necessary UI components with different styles, themes, views, and layouts

CLO3	Examine and implement the required services such as messaging, mailing, multimedia concepts for the given problem
CLO4	Test and debug the Android applications with different inputs.
CLO5	Create mobile applications that make use of various android features, functions and database tasks

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	2	3	3	3
CLO2	3	3	3	2	3	3
CLO3	3	3	2	2	3	3
CLO4	3	3	3	3	3	3
CLO5	3	3	2	2	3	3
Weightage of course contribute to each PSO	15	15	12	12	15	15

CORE X-LAB: INTERNET OF THINGS-PRACTICAL

Code : P23IT3P7

Hours/Week: 6

Semester : III

Credits: 4

Learning Objective: To gain experience in working with IoT Applications developed using Python with Raspberry Pi Micro-controller.

1. Basic Programming with Digital and Analog Ports.
 - a) Programming the Digital Ports using Raspberry pi with LED
 - b) Reading Analog Data from potentiometer using Raspberry Pi3 with Python
2. Interfacing RGB LED using Raspberry Pi3 with Python
3. Temperature Measurement with LCD Interface.
4. Interfacing DC Motor, Stepper Motor and Servo Motors.
 - a) DC Motor Interfacing with Raspberry Pi3 using Python
 - b) Stepper Motor Interfacing with Raspberry Pi3
 - c) 4C Interfacing Servo motor with Raspberry Pi3
5. IR Remote and IR Receiver Interfacing.
6. Interfacing Wi-Fi and GSM with Controllers
7. Designing Online Voltmeter.
8. Interfacing LoRa Module with Raspberry Pi3.
9. Designing IoT Clock.
10. Designing Online Radio.
11. Cloud Application employing Device Management and Security.

Text Book(s):

1. ArshdeepBahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015 (Unit I and II)
2. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014(Unit III, IV and V).

Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.

Web References:

1. https://www.tutorialspoint.com/internet_of_things/
2. <https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/>
3. [https://www.slideshare.net/khusuma/domain-specific-iot\(Unit-II\)](https://www.slideshare.net/khusuma/domain-specific-iot(Unit-II))
4. [https://www.slideshare.net/PascalBodin/an-introduction-to-m2m-iot-technologies\(Unit -III\)](https://www.slideshare.net/PascalBodin/an-introduction-to-m2m-iot-technologies(Unit -III))
5. https://www.smartgrid.gov/the_smart_grid/smart_grid.html

COURSE OUTCOMES:

After the successful completion of this course, the students will be able to

CLO. No.	Course Outcomes	Level	Exercise
CLO1	Build Raspberry Pi and program to access ports	K3	1
CLO2	Identify RGB LED, 7 segment display and temperature measurement using sensors	K3	2 – 3
CLO3	Examine different motors and IR sensors	K4	4 – 5
CLO4	Determine Wi-Fi and GSM controller and design online Voltmeter	K5	6 – 7
CLO5	Interface LoRA and using RTC design IoT Clock	K5	8 –11

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	2	3	2	2
CLO2	3	2	2	3	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to each PSO	15	11	11	13	14	13

ELECTIVE V: RESEARCH METHODOLOGY

Code : P23IT3:A
Semester : III

Hours/Week: 3
Credits: 3

Learning Objective: To impart knowledge and skills required for research problem formulation, analysis, solutions, technical paper writing and drafting and filing patents.

UNIT I

Research Methodology: Objectives and motivation of research - Types of research - Research approaches - Significance of research - Research methods verses methodology - Research and scientific method - Importance of research methodology - Research process - Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations- Criteria of good research. Defining the research problem: Definition of research problem - Problem formulation - Necessity of defining the problem - Technique involved in defining a problem.

UNIT II

Literature Survey and Data Collection: Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet. Effective literature studies approaches, analysis, plagiarism, and research ethics. Data - Preparing, Exploring, examining and displaying.

UNIT III

Research Analysis and Design: Meaning of research design - Need of research design - Different research designs - Basic principles of experimental design - Developing a research plan - Design of experimental set-up - Use of standards and codes. Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV

Intellectual Property Rights: Nature of Intellectual Property: Patents, Designs, Trade and Copyright- Process of Patenting and Development: technological research, innovation, patenting, development- Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V

Patent Rights: Scope of Patent Rights- Licensing and transfer of technology- Patent information and databases- Geographical Indications -New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs -Licenses, Licensing of related patents, patent agents, Registration of patent agents.

TEXT BOOKS

1. R. Ganesan, "Research Methodology for Engineers", MIP Publishers, Chennai, 2011.
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.

Reference Books:

1. Peter S. Menell, Mark A. Lemley, Robert P. Merges, "Intellectual Property in the New Technological "Vol. I Perspectives, 2021.
2. Laura R. Ford, "The Intellectual Property of Nations: Sociological and Historical Perspectives.
3. RatanKhananabis and SuvasisSaha, "Research Methodology", Universities Press, Hyderabad, 2015.
4. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2010

Web References:

1. <https://www.coursera.org/courses?query=research%20methodology>
2. <https://www.researchgate.net/topic/Research-Methodology>
3. https://www.wto.org/english/tratop_e/trips_e/intell1_e.htm
4. <https://www.isical.ac.in/~palash/research-methodology/RM-lec9.pdf>
5. https://mrcet.com/downloads/digital_notes/CSE/Mtech/I%20Year/RESEARCH%20METHODLOGY.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding of research, IPR and patent fundamentals
CLO2	Identify the issues involved in research, IPR and patent filing
CLO3	Apply suitable instrumentation and sampling techniques for the research studies and recognize the framework for protecting IPR and process for obtaining patents
CLO4	Analyze data, and interpret research findings using appropriate methods and importance of IPR and patent protection in promoting research and development
CLO5	Design and develop research reports, research proposals, academic papers and patents

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	2	3	2	2
CLO2	3	2	2	3	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to each PSO	15	11	11	13	14	13

ELECTIVE V: INTERNET OF THINGS

Code : P23IT3:B
Semester : III

Hours/Week: 3
Credits: 3

Learning Objectives: The primary objective of this course is to impart the knowledge on IoT Architecture, Protocol, various technologies and the application areas relating to IoT implementations.

UNIT I:

Introduction to IoT - Introduction to Internet of Things: Introduction- Physical Design of IoT- Logical Design of IoT- IoT Enabling Technologies - IoT Levels & Deployment Templates

UNIT II:

Domain Specific IoT: Introduction-Home Automation-Cities-Environment-Energy-Retail- Logistics-Agriculture-Industry-Health & Lifestyle. IoT and M2M: Introduction - M2M- Difference between IoT and M2M - SDN and NFV for IoT..

UNIT III:

M2M to IoT- An Architectural Overview: Building an Architecture-Main design principles and needed capabilities-An IoT Architecture Outline- Standard Considerations. M2M and IoT Technology Fundamentals: Devices and Gateways-Local and wide area Networking-Data Management.

UNIT IV:

IoT Architecture - Architecture Reference Model: Introduction-Reference Model and Architecture- IoT Reference Model: IoT Domain Model-Information Model-Functional Model- Communication Model-Safety, Privacy, Trust, Security Model IoT.

UNIT V:

Implementation Examples: The Smart Grid-Introduction-Smart Metering-Smart House-Smart energy city. Case Study: Commercial Building automation today and in the future.

Text Book(s):

3. ArshdeepBahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015 (Unit I and II)
4. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014(Unit III, IV and V).

Reference Books:

4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
5. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012
6. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.

Web References:

6. https://www.tutorialspoint.com/internet_of_things/
7. <https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/>
8. [https://www.slideshare.net/khusuma/domain-specific-iot\(Unit-II\)](https://www.slideshare.net/khusuma/domain-specific-iot(Unit-II))
9. [https://www.slideshare.net/PascalBodin/an-introduction-to-m2m-iot-technologies\(Unit -III\)](https://www.slideshare.net/PascalBodin/an-introduction-to-m2m-iot-technologies(Unit -III))

10. https://www.smartgrid.gov/the_smart_grid/smart_grid.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the fundamental concepts and Terminologies of IoT
CLO2	Determine the IoT enabling technologies, M2M and IoT, fundamentals and technological challenges faced by IoT in terms of Safety, privacy and trust
CLO3	Identify the different levels, models and standards of IoT and application areas in domain specific IoT
CLO4	Analyze the physical design, logical design, architecture Overview of M2M and IoT and reference models of IoT Architecture
CLO5	Assess the application areas and illustrate the implementation of IoT

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	2	2	3
CLO2	3	2	2	2	3	3
CLO3	3	3	2	2	3	3
CLO4	3	3	2	3	2	2
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	13	12	12	13	14

ELECTIVE V: TRENDS IN COMPUTING

Code : P23IT3:C
Semester : III

Hours/Week: 3
Credits: 3

Learning Objectives:

The primary objective of this course is to give students:

- To understand the concepts and infrastructure of cloud computing and its business applications.
- To understand the scope, design and model of grid computing
- Knowledge about the reduction of energy use, waste, and other environmental impacts of Information Technology systems.

UNIT I

Cloud Computing: Basics: Overview – Applications – Intranets and the Cloud – First Movers in the Cloud – Organization and Cloud Computing: Benefits – Limitations – Security Concerns- The Business Case for Going to the Cloud: Cloud Computing Services -Deleting Datacenter..

UNIT II

Hardware and Infrastructure: Clients – Security – Network –Services- Accessing the Cloud: Platforms - Cloud Storage: Overview – Cloud Storage Providers..

UNIT III

Developing Applications: Google – Microsoft - Local Cloud and Thin Clients: Virtualization – Server Solutions – Thin Clients – Migrating to the Cloud..

UNIT IV

Grid Computing: Introduction - Benefits – Grid Terms and Concepts: Types of Resources – Jobs and Applications –Scheduling, Reservation and Scavenging – Grid Software Components – Grid user role: User Perspective – Administrator Perspective - Design: Building grid architecture - Models – Topologies – Phases and Activities.

UNIT V

Green Computing: Introduction - History of Green Computing - Regulations and Industry Initiative - The Demons behind Green Computing - Approaches to Green Computing - Role of IT vendors - Green Computing Tips - Future is Green.

Text Books:

- Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing - A practical Approach", McGraw Hill, 2010.
- Bart Jacob, Michael Brown, Kentaro Fukui, and NiharTrivedi, "Introduction to Grid Computing", IBM Redbook, 2005.

References Books:

- George Reese, "Cloud Application Architectures: Building Applications and Infrastructures in the cloud", O'Reilly Media Inc., 2009.
- Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, "Cloud Computing for Dummies", Wiley India Pvt Ltd, 2009.
- J. Velete, Anthony T. Velete, Robert Elsenpeter, "Green IT – Reduce Your Information System's Environmental Impact While Adding to the Bottom Line", McGraw-Hill, 2008.

- Bud E. Smith ,” Green Computing: Tools and Techniques for Saving Energy, Money, and Resources”, Auerbach Publications , 2013.

Web References:

- http://www.siteground.com/tutorials/cloud/cloud_computing_infrastructure.htm
- <http://thecloudtutorial.com/>
- <http://studymafia.org/wp-content/uploads/2015/11/CSE-Green-Computing-Report.pdf>
- http://www.znu.ac.ir/data/members/dastjerdi_mohammad/Book11.pdf (Unit IV)
- <http://www.cs.kent.edu/~farrell/grid06/lectures/grid01.pdf> (Unit V)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the history, applications, benefits and limitations of Cloud, Grid and Green computing
CLO2	Describe the cloud infrastructure services, virtualization and determine how applications can be developed using cloud services
CLO3	Identify cloud storage providers, software components of grid, technologies applied in building a green system and various key sustainability in Green IT Trends
CLO4	Analyse the migrations and security concerns of cloud, different grid models, resources and also identify how the distributed computing environments can be built from lower level services
CLO5	Assess the business cases of cloud, and also various laws, approaches and protocols for regulating green IT

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	2	1	1	1	1	1
CLO2	2	2	1	1	1	2
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	3	2
CLO5	3	3	2	2	3	3
Weightage of course contribute to each PSO	13	11	8	8	10	11

NMEC II: MULTIMEDIA TOOLS

Code : P23IT3E2

Semester : III

Hours/Week: 3

Credits: 2

Learning Objective: To obtain hands on training required to handle various components of Multimedia such as text, graphics, animation, audio and video.

UNIT 1

Introduction to Multimedia: – What is Multimedia – Multimedia and Hypermedia – World Wide Web – Overview of Multimedia Software Tools.

Exercises:

1. Working with Text and Styles.
2. Creating shapes and painting (Using Drawing tool, Pen tool, Painting tools, and Brush tools).
3. Working with Text and Styles.
4. Creating shapes and painting (Using Drawing tool, Pen tool, Painting tools, and Brush tools).

UNIT II

Multimedia Authoring and Tools: - Multimedia Authoring – Some Useful Editing and Authoring Tools – VRML.

Exercises:

1. Working with Text and Styles.
2. Creating shapes and painting (Using Drawing tool, Pen tool, Painting tools, and Brush tools).
3. Working with Image size and Resolution.
4. Working with Layers.
5. Transforming and Retouching Images (Cropping, Transforming objects, Clone stamping, Retouching).

UNIT III

Graphics and Image Data Representation: - Graphics / Image Data Types – Popular File Formats - Color in Image and Video: - Color Models in Images – Color Models in Video

Exercises:

1. Working with Image size and Resolution.
2. Working with Layers.
3. Transforming and Retouching Images (Cropping, Transforming objects, Clone stamping, Retouching).
4. Working with color Adjustments on Image.

UNIT IV

Fundamental Concepts in Video: - Types of Video Signals – Analog Video – Digital Video.

Exercises:

1. Creating Frame-by-Frame Animation & Tweened Animation– (motion tween and shape tween).
2. Working with textual effects.
3. Creating buttons and working with scenes.

UNIT V

Basics of Digital Audio: - Digitization of Sound – Musical Instrument Digital Interface – Quantization and Transmission of Audio

Exercises:

1. Creating animation with sound.
2. Recording, Editing and Mixing audio clips.
3. Capturing, Editing and Rendering video clips.

Text Book

1. Ze-Nian Li, Mark S. Drew, “Fundamentals of Multimedia”, Pearsons Education, New Delhi, 2005.

Books for Reference

1. John F. Koegel Bufford, “Mutimedia Systems”, Pearson Education, Delhi, 2005.
2. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Computing, Communications & Applications”, Pearsons Education Inc., New Delhi, 2006.
3. David Hillman, “Multimedia Technology & Applications”, Galgotia Publications, New Delhi, 2010.

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

CLO No.	Course Outcomes	Level
CLO1	Identify and describe various multimedia software tools used in the industry.	K3
CLO2	Develop themselves with useful editing and authoring tools commonly used in multimedia production.	K3
CLO3	Analyse, Transform and retouch images using cropping, object transformation, clone stamping, and retouching techniques.	K4
CLO4	Discuss the basic concepts of digital video and its advantages.	K5
CLO5	Choose digital audio techniques in multimedia projects, including recording, editing, and playback.	K5

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	3	3
CLO2	3	3	3	3	3	2
CLO3	3	3	2	3	3	2
CLO4	3	3	2	3	3	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	15	13	15	15	13

CORE XI: .NET WITH C# PROGRAMMING

Code : P23IT404
Semester : IV

Hours/Week: 6
Credits: 5

Learning Objective: To understand the basics structure of C# programming and the components of Active Server Pages which provide sufficient knowledge to work with SQL Server using Microsoft ADO.NET.

UNIT I

The C# Language : Basics- Variables and Data Types - Variable Operations - Object Based Manipulation - Conditional logic - Loops - Methods - Types, Objects and Namespaces- Delegates.

UNIT II

ASP.Net 4.5 Essentials: Introduction to .NET : Benefits of .NET Framework - **Overview of .NET Framework 4.5 :** Common Language Runtime - Common Type System - Metadata and Assemblies- Introduction to visual studio 2012 IDE: Exploring Visual Studio 2012 IDE - **ASP.NET 4.5 Overview:** ASP.NET Life cycle: Life cycle of an ASP.Net web page- **Developing a Web Application:** File Types in ASP.NET 4.5- Exploring ASP.NET web pages - Understanding ASP.NET 4.5 Directives-**Application structure and State:** The Global.asax Application File- Using states: Application State- Session State-View State-Cookies- Postback and Cross-page posting.

UNIT III

Web Forms: Standard controls: Label control-Button Control-TextBox Control-Literal Control- Placeholder Control- HiddenField Control -Navigation controls: TreeView, Menu and SiteMapPath - Validation controls - **Rich controls:** Calendar Controls- AdRotator control.

UNIT IV

LINQ Queries: Standard Query operators: Filtering operators- Projection operators-Sorting operators-Grouping operators-set operators-Aggregate operators -Lambda Expressions - **Working with Login controls:** Login control- Password Recovery control - Create User Wizard control-Change Password control.

UNIT V

ADO.NET Fundamentals: Configuring your Database - ADO.NET Basics- Direct Data Access - Disconnected Data Access -**Data Binding :** Data Binding with ADO.NET- Data Source Controls - **The Data Controls :** The GridView - Formatting the GridView - Selecting a GridView Row- Editing, Sorting and Paging the GridView- Crystal Report.`

Text Books:

1. Kogent (2013), ASP.NET 4.5 Black Book –DreamtechPress,New Delhi (Unit 2,3,4)
2. Matthew MacDonald (2010), Beginning ASP.NET 4 in C#, Apress.(Unit 1,5)

Reference Books:

1. Greg Buczek(2002), ASP.NET Developer's guide, Tata McGraw Hill Publications.
2. Jesse Liberty, (2002), Programming C#, 3.0, O'Reilly Press.

Web References:

1. www.homeandlearn.co.uk/csharp/csharp.html
2. <http://msdn.microsoft.com/en-us/library//aa645596.aspx>
3. <http://www.csharpkey.com/csharp/>
4. <http://www.w3schools.com/aspnet/default.asp>
5. <http://www.maconstateit.net/tutorials/ASPNET20/default.htm>
6. <http://csharp-station.com/Tutorial/AdoDotNet/Lesson01> (Unit V : ADO.NET Fundamentals)

7. <http://www.c-sharpcorner.com/UploadFile/009464/use-crystal-report-in-Asp-Net-using-C-Sharp/>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the features of C# and ASP.NET concepts to understand the real time applications
CLO2	Identify the salient properties of C# programming concepts and ASP .NET Application
CLO3	List the various stages involved in creating a web form
CLO4	Select the appropriate web controls to develop the web forms
CLO5	Construct a database driven web applications with the facilitated web services.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	3	3
CLO2	3	3	3	3	3	2
CLO3	3	3	2	3	3	2
CLO4	3	3	2	3	3	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	15	13	15	15	13

CORE XII-LAB: .NET WITH C# PROGRAMMING - PRACTICAL

Code : P23IT4P8

Hours/Week: 6

Semester : IV

Credits: 5

Learning Objective: To provide sufficient knowledge in developing web applications and to manipulate data from SQL Server using Microsoft ADO.NET.

Course Outline

1. C# Basics
2. Delegates
3. Lambda Expressions
4. LINQ
5. Usage of Web Sever Controls
6. Usage of AdRotator, Calendar Controls
7. Working with Validation controls
8. Menu Control
9. Cookies, View state, Session
10. Developing Database Applications using Data Grid
11. Creating Crystal Report

Text Books:

1. Kogent (2013), ASP.NET 4.5 Black Book –DreamtechPress,New Delhi

Reference Books:

1. Herbert Schildt,(2010), C# 4.0 The Complete Reference, Tata McGraw Hill Publications..

Web References:

1. <http://www.csharpkey.com/csharp/>
2. <http://www.w3schools.com/aspnet/default.asp>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate simple programs using C# programming concepts such as classes, objects, method overloading
CLO2	Solve complex programs using delegates, Lambda expression and LINQ
CLO3	Analyze the usage of web server controls, calendar controls, validation controls and menu controls in asp.net application
CLO4	Evaluate the role of Cookies, View state and Session state in creating an web Application
CLO5	Design a data driven web application by connecting to the data sources

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	2	3	3
CLO2	3	3	3	3	2	3
CLO3	3	3	3	3	3	2
CLO4	3	3	3	3	3	2
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	15	15	14	14	13

ELECTIVE VI: INTELLIGENT SYSTEMS

Code : P23IT4:A
Semester : IV

Hours/Week: 4
Credits: 3

Learning Objective: To acquire knowledge on various intelligent system techniques and methodologies and to have enriched knowledge on Knowledge representation, problem solving, and learning methods in solving particular engineering problems.

UNIT I

Artificial Intelligence: AI problems-AI technique-Problem Search:-Production Systems – Problem Characteristics – Production system characteristics- Heuristic Search techniques: Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis.

UNIT II

Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations –Frame problem –. Using Predicate Logic: Representing simple facts in logic - Representing Instance and ISA relationships – Computable functions and predicates – Resolution.

UNIT III

Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. **Knowledge representation summary:** Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques.

UNIT IV

Rule-based expert systems: Introduction- Rules as a knowledge representation technique- players- Structure-Forward chaining and backward chaining inference techniques- **Fuzzy expert systems:** Introduction- Fuzzy sets- Linguistic variables and hedges- Operations - Fuzzy rules- - Building a fuzzy expert system.

UNIT V

Artificial neural networks: Neuron- perceptron- Multilayer neural networks- - The Hopfield network- Robotics: Introduction-Robot hardware-Perception-Moving-Robotic software architecture.

Text Books:

1. Elaine rich and Kelvin Knight, “Artificial Intelligence “, Tata McGraw hill Publication, 3rdEdition, 2009.
[Unit - I,II,III]
Unit I : Chapters 1, 2, 3
Unit II: Chapters 4, 5
Unit III: Chapters 6, 11
2. Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011. [Unit IV-Chapter 1,2,4,V-Chapter 6]
3. Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3rd Edition Pearson Education [Unit V-Chapter 25-Robotics]

Reference Books:

1. “Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3rd Edition, Pearson Education.
2. “Artificial Intelligence “, George F Luger , 4thEdition , Pearsons Education Publ, 2002.
3. “Foundations of Artificial Intelligent And Expert Systems”, V S Janaki Raman, K Sarukesi, P Gopalakrishnan, Macmillan India Limited

Web References:

1. <https://www.techopedia.com/definition/190/artificial-intelligence-ai>
2. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm
3. <https://data-flair.training/blogs/heuristic-search-ai/>
4. <http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf>
5. <http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the applicability, strength and weakness of artificial intelligence in solving computational problems
CLO2	Demonstrate the role of knowledge representation, problem solving and learning in Intelligent-system engineering
CLO3	Identify the characteristics of AI, Knowledge representation, Experts systems and its variants with ANN and robotics.
CLO4	Analyze a comprehensive background in both software and hardware to work with the future of robotics and adaptive systems
CLO5	Assess the scientific background through various real time examples

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	2	2
CLO2	3	3	3	3	2	2
CLO3	3	2	3	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	2
Weightage of course contribute to each PSO	15	12	12	15	13	11

ELECTIVE VI: INTRODUCTION TO ROBOTICS

Code : P23IT4:B

Hours/Week: 4

Semester : IV

Credits: 3

Learning Objectives: To introduce students to fundamental components, functionality of Robotic systems and to provide knowledge in the design and development challenges in the field of robotics.

UNIT I

Introduction-Definition of Automation-Mechanization Vs Automation-Advantages-Goals-Social Issues-Types-Current Emphasis in Automation-Issues in automation in Factory Operations-Strategies of Automation

UNIT II

Introduction -History of Robots- Definition- Laws of Robotics-Characteristics-Components-Comparison of the Human and the Robot Manipulator-Robot Wrist and End of Arm Tools-Robot Terminology-Robotic Joints-Classification-Selection-Workcell-Robotics and Machine Vision-Applications

UNIT III

Robot Components: Sensors: Exteroceptors Sensors -Tactile Sensors -Proximity Sensors-Range Sensors-Machine Vision Sensors-Velocity Sensors-Proprioceptors-Robots with sensors-
- End Effectors: Grippers-selection of grippers-Gripping mechanism- tools-Types of Grippers- Drives: Pneumatic, Hydraulic, Electric Actuators

UNIT IV

Transformations: Introduction to Manipulator Kinematics -Homogeneous Transformations-Robot Kinematics-Manipulator Path Control-Robot Dynamics- **Robot Programming Techniques:** Online programming- Lead-through Programming-Offline Programming-Task Level Programming-Motion Programming-Robot Programming Languages-Robot languages and its types.

UNIT V

Applications of Robots: Robot Capabilities-Application of Robots-Manufacturing Applications-Material handling applications **Robotics and Artificial Intelligence:** Vision-Voice communication-Planning-Modelling-Adaptive control-Error monitoring and recovery-Autonomy and intelligence in robots-Expert systems in robotics.

Text Books:

1. Gupta.A.K, Arora. S. K., Industrial Automation and Robotics, Mercury Learning and Information, 2017(Unit I,II ,III,IV,V)
2. Mikell P Groover, "Industrial Robotics", Mc GrawHill, 2012.(Unit III: Drives :Fundamentals of Robot technology -Robot Drive systems, Unit IV: Transformations)
3. D.J.Todd, "Fundamentals of Robot Technology", An Introduction to Industrial Robots, Teleoperators and Robot Vehicles, Wiley,1986.(Unit V: Robotics and Artificial Intelligence)

Reference Books:

1. Thomas. K. Rufuss, "Robotics and Automation Handbook", CRC Press, 2018
2. Ghoyal.K., Deepak Bhandari, "Automation and Robotics", S.K.Kataria& Sons Publishers, 2012.
3. John.J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson, 2018.
4. Gonzalez, Fu Lee, Robotics: Control, Sensing, Vision and Intelligence, Wiley, 1998

Web References:

1. <https://builtin.com/robotics>
2. <https://www.elprocus.com/robot-sensor/>
3. <https://sp-automation.co.uk/the-top-seven-types-of-robots/>
4. <https://robots.ieee.org/learn/types-of-robots/>

5. <https://www.intel.in/content/www/in/en/robotics/types-and-applications>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the anatomy, specifications and applicability of Robotic system
CLO2	Demonstrate the role of kinematics and dynamic behavior of robots with programming techniques
CLO3	Identify the characteristics and functionality of robots in various sectors.
CLO4	Analyze the various functionality of robotic systems with respect to software and hardware components
CLO5	Assess the scientific background of robotic systems through various real time examples

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	1	2	2	2
CLO2	3	3	3	3	3	2
CLO3	3	2	3	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	10	10	14	14	12

ELECTIVE VI: VIRTUAL AND AUGMENTED REALITY

Code : P23IT4:C

Hours/Week: 4

Semester : IV

Credits: 3

Learning Objective: To provide knowledge on basic principles of virtual & augmented reality and have the ability to use its technology as a platform for real-world applications.

Unit I

Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –**Input Devices:** Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces

Unit II

Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - **Computer Architecture for VR:** The Rendering Pipeline- PC Graphics Architecture - **VR Programming:** Toolkits and Scene Graphs – Traditional and Emerging Applications of VR.

Unit III

Augmented Reality: Introduction – **Augmented Reality Concepts:** Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience

Unit IV

Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies

Unit V

Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - **Mobile Augmented Reality:** Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality

Text Books:

1. Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9)
2. Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8)
3. Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)

Reference Books:

1. Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers)
2. Paul Mealy (2018), "Virtual and Augmented Reality",Wiley
3. Bruno Araldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley

Web References:

1. Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, <https://nptel.ac.in/courses/121106013>
2. Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, <https://www.youtube.com/watch?v=MGuSTAqLZ9Q>

3. <http://msl.cs.uiuc.edu/vr/>
4. <http://www.britannica.com/technology/virtual-reality/Living-in-virtual-worlds>
5. <https://mobidev.biz/blog/augmented-reality-development-guide>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic terminologies, techniques and applications of VR and AR
CLO2	Describe different architectures and principles of VR and AR systems
CLO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications
CLO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition
CLO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	1	2	2	2
CLO2	3	2	2	2	2	2
CLO3	3	2	2	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	9	10	13	13	12

SEC-Skills Enhancement for IT Professionals and Entrepreneurs

Code : P23IT4S1
Semester : IV

Hours/Week: 4
Credits: 2

Learning objectives: To develop an understanding of employability, professional and communication skills, by identifying industry trends, required skills, and available opportunities.

UNIT I

Employability Skills-Employability Skills for the current job market and future of work-Employability related GOI and private portals and their usage-Different industries, trends, required skills and the available opportunities-

UNIT II

Becoming a Professional-Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn -Continuous learning mindset for personal and professional development

UNIT III

Listening and speaking skills-Basics of communication-Elements of communication-Barriers of communication-Types of communication- Active listening- Effective speaking-Listening and Speaking-Effective presentation strategies- Group communication- **Reading and writing skills**- Reading techniques-Technical writing-Art of condensation- Writing letters, memos, emails and reports-resume preparation

UNIT IV

Career Development & Goal Setting-Career development plan-Short- and long-term goals **Getting ready for Jobs**-Drafting Curriculum Vitae (CV)-offline and online job search- interviews.

UNIT V

Entrepreneurship-Different types of Entrepreneurships and Enterprises-research and networking skills -develop a business plan and a work model-sources of funding-financial/ legal hurdles for the business-**Customer Service**-different types of customers- tools to collect customer feedback- responding to customer requests.

Text Books:

1. Meenakshi Raman and Sangeeta Sharma, "Technical communication: Principles and practice",. 2/e. Oxford university Press India. 2011
2. P. Saravanel, "Entrepreneurship Development Principles, Policies and Programmes", Ess Pee Kay Publishing House, Chennai, 1997.