

# **M.C.A. (2 Years)**

## **SYLLABUS**

**with effect from AY 2023-24**

**DEPARTMENT OF COMPUTER SCIENCE &  
ENGINEERING,  
M S UNIVERSITY,  
TIRUNELVLEI – 627 012**

## **Vision of the University**

To provide quality education to reach the un-reached

## **Mission of the University**

- To conduct research, teaching and outreach programmes to improve conditions of human living.
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development.
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically down trodden students including women, socially oppressed and differently-abled.

## **Vision & Mission of the Department**

### **Vision**

- To create industrious and research-oriented professionals in the field of Computer Science and Engineering

### **Mission**

- To achieve academic excellence by, providing an environment that combines Computing practice and research
- Giving an exposure to the area of Computer Science and the underlying mathematics to impart research skills and career goals giving an opportunity to the rural and underprivileged students to pursue Higher Education

## **Preamble**

The Department of Computer Science and Engineering is one of the few departments functioning from the inception of the university in 1990. The Department is offering M.C.A (2 years), M.Sc. (CS), M.E. (CSE) and Ph.D. programmes. The M.C.A programme is approved by the AICTE.

MCA is a Professional PG degree Programme which provides students with an opportunity to develop technical computing skills and core competence in the field of software development. The Learning Outcome based Curriculum Framework (LOCF) for the program has been formulated with the Regulations, Program Specific Outcomes, Course outcomes, curriculum structure, the detailed syllabus for the Core, allied, Practical, supportive, and skill-based courses; and the guidelines for the project works / internship activities. The Curriculum focuses on imparting conceptual knowledge, coding skills, software development and debugging, software testing and maintenance, and problem-solving using computers.

## **REGULATIONS**

**Duration of the Programme: Two years (4 semesters)**

### **Eligibility:**

Passed any graduation degree (e.g.: B.E. / B.Tech. / B.Sc / B.Com. / B.A./ B. Voc. / BCA etc.,) preferably with Mathematics at 10+2 level or at Graduation level.

Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying examination.

For students having no Mathematics background compulsory bridge course will be framed by Manonmaniam Sundaranar University and additional bridge courses related to computer subjects as per the norms of Manonmaniam Sundaranar University.

The students who have not studied Mathematics either at 10+2 level or at Graduation level have to study any one Mathematical Foundations course available in the MOOC platform preferably in the first semester. The bridge course is mandatory for the successful completion of MCA (2 years) programme.

### **Entrance Test:**

Applicants seeking admission to MCA (2 years) programme are required to appear for the **Entrance Test (TANCET)** by Anna University or **University Entrance Test (UET)** by M S University in the respective year. Details of the University Entrance Test will be provided in the University Website at the time of admission notification. Previous year TANCET / UET score will not be considered for admission

### **Selection:**

Selection of students for the MCA (2 years) programme shall be based on the combined marks obtained by the student in **Part-III** of the qualifying UG degree examination / % of marks or CGPA in case of UG programme in Engineering/Technology and the **Entrance Test (TANCET / UET) Score** in the respective year. The weightage for the qualifying UG degree examinations and the Entrance test score will be **50%each**. In case of applicant having both TANCET & UET scores, the higher score among the two will be considered.

Selection of students for the available seats shall be based on the rank obtained by the student in the **Merit list** as per Manonmaniam Sundaranar University admission guidelines and the Tamil Nadu Government reservation norms.

### **Admission**

- The Admission of students to the MCA (2 years) programme shall be done through a Common Counseling Process. The modalities of the Counseling will be decided by the University at the time of Admission.
- The date and time of counseling shall be communicated through the University website. Individual communication will not be sent in this regard. Students shall furnish all the relevant supporting documents during the counseling.

### **Student Evaluation**

- Evaluation is based on continuous internal assessment (25%) and end-semester examination (75%) for theory courses. The Candidates must have a minimum score of 50% in the end semester examinations and 50% of total (internal & External) in each theory courses. The maximum Internal mark is 50 and the maximum External mark is 50 for the Practical courses /Mini Project/Major Project/Field Work/Internship.
- A Minimum of 75% attendance is required to appear for the University Examinations.
- The student shall be awarded the respective degree upon successful completion of the programme as per university norms.

<b>TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION</b>	
<b>Programme</b>	<b>M.C.A.</b>
<b>Programme Code</b>	
<b>Duration</b>	<b>PG - Two Years</b>
<b>Programme Outcomes (Pos)</b>	<p><b>PO1: Problem Solving Skill</b> Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.</p> <p><b>PO2: Decision Making Skill</b> Foster analytical and critical thinking abilities for data-based decision-making.</p> <p><b>PO3: Ethical Value</b> Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.</p> <p><b>PO4: Communication Skill</b> Ability to develop communication, managerial and interpersonal skills.</p> <p><b>PO5: Individual and Team Leadership Skill</b> Capability to lead themselves and the team to achieve organizational goals.</p> <p><b>PO6: Employability Skill</b> Inculcate contemporary business practices to enhance employability skills in the competitive environment.</p> <p><b>PO7: Entrepreneurial Skill</b> Equip with skills and competencies to become an entrepreneur.</p> <p><b>PO8: Contribution to Society</b> Succeed in career endeavors and contribute significantly to society.</p> <p><b>PO 9 Multicultural competence</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective.</p> <p><b>PO 10: Moral and ethical awareness/reasoning</b> Ability to embrace moral/ethical values in conducting one's life.</p>
<b>Programme Specific Outcomes (PSOs)</b>	<p><b>PSO1 – Placement</b> To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p>

	<p><b>PSO 2 - Entrepreneur</b> To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p><b>PSO3 – Research and Development</b> Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p><b>PSO4 – Contribution to Business World</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p><b>PSO 5 – Contribution to the Society</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit.</p>
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**Template for P.G., Programmes**

<b>Semester-I</b>	<b>Credit</b>	<b>Hours</b>	<b>Semester-II</b>	<b>Credit</b>	<b>Hours</b>	<b>Semester-III</b>	<b>Credit</b>	<b>Hours</b>	<b>Semester-IV</b>	<b>Credit</b>	<b>Hours</b>
Core-I	4	4	Core-IV	4	4	Core-VII	4	4	Major Project with viva voce	15	30
Core-II	4	4	Core-V	4	4	Core-VIII	4	4			
Core - III	4	4	Core - VI	4	4	Core - IX	4	4			
Elective -I Discipline Centric	4	4	Elective - III Discipline Centric	4	4	Elective - V Discipline Centric	4	4			
Elective-II Discipline Centric	4	4	Elective -IV Discipline Centric	4	4	Elective - VI Discipline Centric	4	4			
Lab I	2	4	Lab III	2	4	Lab V	2	4			
Lab II	2	4	Lab IV	2	4	Mini Project/ Internship/ Industrial Activity	4	4			
Skill Enhancement Course -I	1	2	Skill Enhancement Course-II	1	2	Skill Enhancement -III	1	2			
	<b>25</b>	<b>30</b>		<b>25</b>	<b>30</b>		<b>27</b>	<b>30</b>		<b>15</b>	<b>30</b>
<b>Total Credit Points -92</b>											

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System for all Post – Graduate Courses including Lab Hours**

**First Year – Semester – I**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core – I	4	4
	Core – II	4	4
	Core – III	4	4
	Elective – I	4	4
	Elective – II	4	4
	Lab –I	2	4
	Lab –II	2	4
	Skill Enhancement Course [SEC]-I	1	2
		<b>25</b>	<b>30</b>

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core – IV	4	4
	Core – V	4	4
	Core – VI	4	4
	Elective – III	4	4
	Elective – IV	4	4
	Lab –III	2	4
	Lab –IV	2	4
	Skill Enhancement Course [SEC]-II	1	2
		<b>25</b>	<b>30</b>

**Second Year – Semester – III**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core –VII	4	4
	Core –VIII	4	4
	Core –IX	4	4
	Elective – V	4	4
	Elective – VI	4	4
	Lab –V	2	4
	Mini Project /Internship / Industrial Activity	4	4
	Skill Enhancement Course-III	1	2
		<b>27</b>	<b>30</b>

**Semester-IV**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Major Project with VIVA VOCE	15	30
		<b>15</b>	<b>30</b>

**Total 92 Credits**



<b>METHODS OF EVALUATION</b>		
<b>Internal Evaluation</b>	Continuous Internal Assessment Test	<b>25 Marks</b>
	Assignments / Snap Test / Quiz	
	Seminars	
	Attendance and Class Participation	
<b>External Evaluation</b>	End Semester Examination	<b>75 Marks</b>
<b>Total</b>		<b>100 Marks</b>
<b>METHODS OF ASSESSMENT</b>		
<b>Remembering (K1)</b>	<ul style="list-style-type: none"> <li>• The lowest level of questions require students to recall information from the course content</li> <li>• Knowledge questions usually require students to identify information in the textbook.</li> </ul>	
<b>Understanding (K2)</b>	<ul style="list-style-type: none"> <li>• Understanding of facts and ideas by comprehending, organizing, comparing, translating, interpolating and interpreting in their own words.</li> <li>• The questions go beyond simple recall and require students to combine data together</li> </ul>	
<b>Application (K3)</b>	<ul style="list-style-type: none"> <li>• Students have to solve problems by using/applying a concept learned in the classroom.</li> <li>• Students must use their knowledge to determine an exact response.</li> </ul>	
<b>Analyze (K4)</b>	<ul style="list-style-type: none"> <li>• Analyzing the question is one that asks the student to break down something into its component parts.</li> <li>• Analyzing requires students to identify reasons, causes or motives and reach conclusions or generalizations.</li> </ul>	
<b>Evaluate (K5)</b>	<ul style="list-style-type: none"> <li>• Evaluation requires an individual to make judgment on something.</li> <li>• Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem.</li> <li>• Students are engaged in decision-making and problem-solving.</li> <li>• Evaluation questions do not have single right answers.</li> </ul>	
<b>Create (K6)</b>	<ul style="list-style-type: none"> <li>• The questions of this category challenge students to get engaged in creative and original thinking.</li> <li>• Developing original ideas and problem-solving skills</li> </ul>	

**PROGRAMME OUTCOMES (PO) - PROGRAMME SPECIFIC OUTCOMES (PSO)  
MAPPING**

<b>PROGRAMME SPECIFIC OUTCOMES (PSO)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>PSO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>PSO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>PSO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>PSO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>PSO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Level of Correlation between PO's and PSO's**

*(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)*

Assign the value

**1 – Low**

**2 – Medium**

**3 – High**

**0 – No Correlation**

Course	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
				I. A	ESE	Total
<b>Semester - I</b>						
Core – I Theory Discrete Mathematics	4	4	3	25	75	100
Core – II Theory Linux and shell programming	4	4	3	25	75	100
Core – III Theory Python Programming	4	4	3	25	75	100
Elective – I -Data Engineering and Management/Architecture and Frameworks	4	4	3	25	75	100
Elective – II –Software Development Technologies/ Soft Computing	4	4	3	25	75	100
Lab I - Data Engineering and Management Lab / Architecture and Framework Lab	2	4	3	50	50	100
Lab II - Python Programming Lab	2	4	3	50	50	100
Skill Enhancement Course- Foundation of Digital Business	1	2	3	25	75	100
	<b>25</b>	<b>30</b>				

Course	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
				I. A	ESE	Total
<b>Semester - II</b>						
Core - IV Theory Data Structures and Algorithms	4	4	3	25	75	100
Core - V Theory Big Data Analytics	4	4	3	25	75	100
Core - VI Advanced Computer Networks	4	4	3	25	75	100
Elective - III Internet of Things / Internet of Things Lab/ Computer Vision / Computer Vision Lab	4	4	3	25	75	100
Elective - IV Cyber Security/ Cyber Security Lab/ Block chain Technologies / Block chain Technologies Lab	4	4	3	25	75	100
Lab -III Data Structures and Algorithms Lab	2	4	3	50	50	100
Lab -IV Big Data Analytics Lab	2	4	3	50	50	100
Skill Enhancement Course - Privacy and Security in Online Social Media	1	2	3	25	75	100
	25	30				

Course	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
				I. A	ES E	Total
<b>Semester - III</b>						
Core VII Theory Advanced Java Programming	4	4	3	25	75	100
Core VIII Theory Web Technologies	4	4	3	25	75	100
Core IX Theory Advanced Machine Learning (AML)	4	4	3	25	75	100
Elective -V Industry Dynamics Technology-Data Visualization /Mobile Application Development	4	4	3	25	75	100
Elective -VI Social Networks / High Performance Computing	4	4	3	25	75	100
Lab - V Advanced Java Programming lab	2	4	3	50	50	100
Mini project /Internship/Industrial Activity	4	4	3	50	50	100
Skill Enhancement Course -MOOC course	1	2	3	25	75	100
	27	30				

Course	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
				I. A	ES E	Total
<b>Semester - IV</b>						
Major Project	15	30	3	50	50	100
	15	30				

CREDIT SUMMARY FOR Master of Computer Applications

SEMESTER I	25
SEMESTER II	25
SEMESTER III	27
SEMESTER IV	15
<b>TOTAL CREDITS</b>	<b>92</b>

## Core – I Discrete Mathematics

### Course Objective

- To know the concepts of relations and functions
- To distinguish among different normal forms and quantifiers
- To solve recurrence relations and permutations & combinations
- To know and solve matrices , rank of matrix & characteristic equations
- To study the graphs and its types

### Unit-I

**Relations-** Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations-- Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

### Unit-II

**Mathematical Logic**-Logical connectives-**Well formed formulas** – Truth table of well formed formula –Algebra of proposition –Quine’s method-**Normal forms of well formed formulas**- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-**Rules of Inference for propositional calculus** – **Quantifiers**- Universal Quantifiers- Existential Quantifiers

### Unit-III

**Recurrence Relations-** Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations. **Permutations**-Cyclic permutation- Permutations with repetitions- permutations of sets with indistinguishable objects-**Combinations**- Combinations with repetition

### Unit-IV

**Matrices-** special types of matrices-Determinants-Inverse of a square matrix-Cramer’s rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

### Unit-V

**Graphs** -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs

### Text book

1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

### Reference Book

1. Kimmo Eriksson & Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012

### Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand the concepts of relations and functions distinguish among normal forms	K2	IO
CO2:	To analyze and evaluate the recurrence relations	K4, K5	HO
CO3:	To distinguish among various normal forms and predicate calculus	K5	HO
CO4:	To solve and know various types of matrices	K1	LO
CO5:	To evaluate and solve various types of graphs	K5	HO

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	S	M	M	S	M	M
CO3	S	S	M	M	M	S	M	L	M	S	M	M
CO4	S	S	M	L	S	S	M	M	L	S	M	S
CO5	S	S	M	S	S	S	S	S	L	S	M	S

**S- Strong; M-Medium; L-Low**



## Core – II Linux and Shell Programming

### Course Objective

- To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To facilitate students in understanding Inter process communication, semaphore and shared memory.
- To explore real-time problem solution skills in Shell programming.

### Unit-I

**Basic bash Shell Commands:** Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:**Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:**Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

(Book-1, Chapters: 3, 11, and 12)

### Unit-II

**More Structured Commands:** Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

(Book-1, Chapters: 13, 14, and 16)

### Unit-III

**Creating Functions:** Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for**

**Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

(Book-1, Chapters: 17, 18, and 19)

#### **Unit-IV**

**Regular Expressions:** Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

(Book-1, Chapters: 20, 21, and 22)

#### **Unit-V**

**Working with Alternative Shells:** Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh.**Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

(Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14)

#### **Text book:**

1. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3<sup>rd</sup> Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, 2<sup>nd</sup> Edition, 2018. **Chapter:** 14.

#### **Reference Books:**

1. CliffFlynt,SarathLakshman,ShantanuTushar, "Linux Shell Scripting Cookbook ", Packt Publishing, 3<sup>rd</sup> Edition, 2017.

2. Stephen G.Kochan, Patrick Wood, "Shell Programming in Unix, Linux, and OS X", Addison Wesley Professional, 4<sup>th</sup> Edition, 2016.
3. Robert Love, "Linux System Programming", O'Reilly Media, Inc, 2013
4. W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013
5. Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

### Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python	K1-K6

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	L	-	M	M	M	M	S
CO2	S	S	M	-	S	L	-	M	M	M	M	S
CO3	S	S	M	-	S	L	-	M	M	S	S	S
CO4	S	S	M	-	S	L	-	M	M	M	M	S
CO5	S	S	M	-	S	L	-	M	M	M	M	S

**S- Strong; M-Medium; L-Low**

## Core – III Python Programming

### Course Objectives:

- To acquire programming skills in core Python
- To learn Strings and function
- To develop object oriented skills in Python
- To comprehend various Python Packages
- To develop web applications using Django

### Unit I

Introduction : Fundamental ideas of Computer Science - Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop

### Unit II

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program’s namespace - Higher-Order Functions

### Unit III

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism - GraphicalUser Interfaces - The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events

### Unit IV

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The DataFrame- The Index Objects – Data Vizualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

## Unit V

Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

### Text Book:

1. K.A. Lambert, "Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 **(Unit - IV)**
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020 **(Unit - V)**

### Course Outcomes

**On the successful completion of the course, students will be able to**

<b>CO1</b>	Comprehend the programming skills in python and develop applications using conditional branches and loop	<b>K1- K6</b>
<b>CO2</b>	Create python applications with strings and functions	
<b>CO3</b>	Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism	
<b>CO4</b>	Evaluate the use of Python packages to perform numerical computations and data visualization	
<b>CO5</b>	Design interactive web applications using Django	

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	M	M	S

**S- Strong; M-Medium; L-Low**

## **Elective – I Data Engineering and Management**

### **Course Objectives:**

- To understand Data Management concepts
- To get brief knowledge on Data Modeling
- To analyse the techniques used in Distributed Databases
- To assess Distributed database and Business Modelling
- To get familiar with CRM tools

### **Unit-I**

**DATABASE DEVELOPMENT:** Database architecture of an information system- Overview of the database development process-Conceptual data modeling- Relational data analysis-Roles of a data model-Physical database design. **DATA MANAGEMENT:** Problems encountered without data management-Data management responsibilities-Data management activities-Roles within data management-Benefits of data management-Relationship between data management and enterprise

### **Unit-II**

**CORPORATE DATA MODELLING:** Need for a corporate data model-Nature of a corporate data model- Develop a corporate data model - Corporate data model principles. **DATA DEFINITION AND NAMING:** Elements of a data definition-Data naming conventions. **DATA QUALITY:** Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. **DATA ACCESSIBILITY:** Data security-Data integrity-Data recovery

### **Unit-III:**

**USE OF PACKAGED APPLICATION SOFTWARE:** Application software packages-Impact on data management. **DISTRIBUTED DATA AND DATABASES:** Rationale for distributing data-Perfect distributed database system-Top down fragmentation and partitioning. Bottom up integration-The management of replication. **BUSINESS INTELLIGENCE:** Data warehousing- Multidimensional model of data-Standard reporting tools-Online analytical processing OLAP-Relational schema for a data warehouse.

### **Unit-IV:**

**CRM:** Three main pillars of CRM. **GETTING TO KNOW YOUR CUSTOMER:** 360-degree client view. **UTILIZING ARTIFICIAL INTELLIGENCE AND MACHINE**

LEARNING IN YOUR CRM STRATEGY: Evolution of AI-Current state of AI-Teaming up AI with people-Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes.

**Unit-V:**

CLOUD VERSUS ON PREMISE VERSUS HYBRID: Factors influencing vendor selection-Hybrid deployment-what are your options. CRM DIFFERENTIATORS: It’s not about the feature list; it’s about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud or not to cloud-Leveraging smart cloud into CRM-Big data-Social selling and advertising-Implementation tools-Sustainable CRM platform.

**Text Books:**

1. Keith Gordon, "Principles of Data Management Facilitating Information Sharing", BCS Learning, 2013. (Chapters:1-5, 7,8,12,13,14)
2. Max Fatouretchi, "The Art of CRM", Packt Publishing, 2019.(Chapters: 1,2,5,8,9)

**Reference Books:**

1. Peter Ghavami, "Big Data Management\_ Data Governance Principles for Big Data Analytics", De Gruyter, 2020.
2. Francis Buttle, Stan Maklan, Customer Relationship Management Concepts and Technologies, Routledge, 2019.

**Course Outcome:**

On the successful completion of the course, students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Comprehend the Data Management concepts and analyse the relationship with the enterprise	K1- K6
CO2	Analyze Data Modelling concepts and assess its quality	
CO3	Understand and implement business modelling techniques	
CO4	Evaluate the use of Artificial Intelligence and Machine Learning in CRM	
CO5	Develop CRM applications in cloud	

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

### Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	M	M	S

L - Low, M- Medium, S – Strong



## **Elective – I Architecture and Frameworks**

### **Course Objectives**

- To understand the basics, benefits and purpose of software architecture
- Understand the quality attributes to fulfil the software requirements and relates the software with an organization
- Explore the design patterns, best practice and paradigms of efficient software development
- Understand the performance and security measures of software architecture
- Enable the developers to advance their carrier in software domain

### **Unit – I**

Software architecture introduction – Importance of Software architecture – Software architecture consumers – Architect role - software architecture in an organization – Types of software architects – Software development methodologies – Project management – Office politics – Software risk management – Configuration management – Software product lines

### **Unit – II**

Domain Knowledge – Developing business acumen – Domain-driven design – requirement engineering – requirement elicitation –Software Quality attributes: Maintainability – Usability –Availability – Portability – Interoperability - Testability

### **Unit – III**

Software Architectures design – Importance - Top-down Versus bottom-up design approaches – Architectural drivers – Documenting the Software architecture design – Systematic approach - Attribute-driven design – Microsoft’s technique for architecture and design –Architecture-centric design method – Architecture development method – Tracking the progress of the software architecture’s design.

## Unit – IV

Designing orthogonal software systems – Minimizing complexity – SOLID design principles – Software architecture patterns – layered – Event-driven architecture – Model-View patterns – Service-oriented architecture

## Unit – V

Architecting Modern Applications.- Importance of Performance – Performance improvement - Server side caching – Web application performance – Database performance -Securing software systems – Threat modelling – Secure by design

### Text Book

1. Joseph Ingeno, "Software Architect's Handbook" Packt Publishing 2018.

### Reference books

1. Oliver Vogel, Indo Arnold, ArifChughtaiandTimoKehrer, "Software Architecture" Springer-Verlag, 2011.
2. Ian Gorton, "Essential Software architecture", Second Edition, Springer, 2011
3. Len Bass, Paul Clements and Rick Kazman, "Software architecture in practice", Third edition, Addison-Wesley, 2013

### Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management	K1-K6
CO2	Comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes.	K1-K6
CO3	Understand, track and examine the systematic approach for various software design models with effective document process	K1-K6
CO4	Illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture	K1-K6
CO5	Comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications	K1-K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create**

## Mapping with Programme Outcome

	PO1	PO 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12
CO 1	M	S	-	L	M	S	M	M	L	S	-	-
CO 2	M	S	-	M	M	L	S	S	M	M	S	-
CO 3	S	M	-	S	S	M	S	M	M	S	M	-
CO 4	S	M	L	S	M	L	S	L	S	M	S	M
CO 5	M	S	M	L	S	L	M	S	L	S	-	M

**S- Strong; M-Medium; L-Low**

## Elective – II Software Development Technologies

### Course Objectives

- To learn and Implementing Micro services
- To analysing the Azure Kubernetes Service
- To learn and anlyse .NET DevOps for Azure and its applications
- To building code for .NET core applications
- To get familiarized with Azure pipelines

### Unit -I

**Implementing Microservices:** Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring.

### Unit-II

**Azure Kubernetes Service (AKS):** Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implenting security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges. Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.

### Unit-III

**.NET DevOps for Azure:** DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.

## **Unit-IV**

**Building the code:** Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

## **Unit-V**

**Introduction to APIs:** Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization.

## **Text Book**

1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure- Designing, Developing, Deploying, and Monitoring, Apress, 2019.
2. Jeffrey Palermo , NET DevOps for Azure A Developer's Guide to DevOps Architecture the Right Way, Apress, 2019.
3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

## **Reference Books**

1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass,IngoWeber,LimingZhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication, First Ediiton 2015.
3. John Ferguson Smart,"Jenkins, The Definitive Guide", O'Reilly Publication, First Ediiton 2011.

## Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, apply and summarize the basic concepts of Micro services communication Microsoft Azure and Dev Ops for software development life cycle	K1-K6
CO2:	To illustrate, and implement Azure Kubernetes Service tools for software development life cycle	K1-K6
CO3:	To recognize, analyse and summarize the functionalities of .NET Dev Ops for Azure applications	K1-K6
CO4:	To understand, design and evaluate the principles and architecture service tools for software development life cycle.	K1-K6
CO5:	To comprehend, implement and review the functionalities of API and API gateways for cloud and Azure applications	K1-K6

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	-	M	-	-	-	S	-	-	-
CO2	S	S	M	-	M	-	-	-	S	-	-	-
CO3	S	S	S	-	S	-	-	-	S	S	S	S
CO4	S	S	M	-	M	-	-	-	S	-	-	-
CO5	S	S	M	-	M	-	-	-	S	-	-	-

**S- Strong; M-Medium; L-Low**

## **Elective – II Soft Computing**

### **COURSE OBJECTIVES:**

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- To understand supervised and unsupervised learning algorithms
- To enable the students to gain a basic understanding of neural networks.
- To know about fuzzy logic, fuzzy inference systems, and their functions.
- To impart basic knowledge on Genetic algorithms and their applications.

### **UNIT-I**

**INTRODUCTION TO SOFT COMPUTING:** Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections- Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability- Hebb Network-Flowchart of Training Process-Training Algorithm.

### **UNIT - II**

**SUPERVISED LEARNING NETWORK :** Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network- Architecture-Flowchart for Training Process-Training Algorithm.

### **UNIT-III**

**UNSUPERVISED LEARNING NETWORK:** Associative Memory Networks - Auto Associative Memory Network-Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear AutoAssociative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

## **UNIT-IV**

**INTRODUCTION TO FUZZY LOGIC:** Classical Sets –Operations on Classical Sets-Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations – Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-Center of Largest Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

## **UNIT-V**

**GENETIC ALGORITHM:** Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming-Characteristics of Genetic Programming-Data Representation.

## **TEXT BOOKS**

1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.

**UNIT I:** Chapter 1: 2.1,2.3,2.4,2.5,2.6,2.7

**UNIT II:** Chapter 2: 3.2,3.3,3.4,3.5,3.6

**UNIT III:** Chapter 3: 4.3,4.4,4.7,5.3

**UNIT IV:** Chapter 4: 7.2,7.3,8.4,9.3,9.4,10,10.2,10.3,10.4,11.4,12.8,14

**UNIT V:** Chapter 5: 15,15.2,15.3,15.4,15.9,15.10

## **REFERENCE BOOKS**

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., &Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence



[Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.
6. Jang, J. S. R., Sun, C. T., & Mizutani, E. (1997). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

### **COURSE OUTCOMES:**

- On the successful completion of the course, students will be able to

<b>CO1</b>	To provide an introduction to the basic principles, techniques, and applications of soft computing	K- 1 K2	LO
<b>CO2</b>	To get familiar with Neural network architectures and supervised learning algorithms	K3	IO
<b>CO3</b>	To understand the architectures and algorithms of Unsupervised Learning techniques	K3- K4	H O
<b>CO4</b>	Develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems	K4	IO
<b>CO5</b>	Ability to learn traditional optimization and search techniques and genetic programming	K5	H O

### **MAPPING WITH PROGRAMME OUTCOMES**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	S	M	S	M	S	S	S	M	S	M	S	S
<b>CO2</b>	M	S	M	S	M	M	M	S	M	S	S	M
<b>CO3</b>	M	M	S	S	S	M	M	S	S	S	S	S
<b>CO4</b>	S	S	M	M	M	S	S	S	S	M	M	M
<b>CO5</b>	S	S	S	S	S	M	S	M	M	S	S	M

**S- STRONG; M-MEDIUM; L-LOW**

## Lab –I Data Engineering and Management Lab

### Course Objectives:

- To acquire basic scripting knowledge in Relational & MongoDB
  - To learn CRUD Operation on Relational & MongoDB database
  - To comprehend MongoDB using DbVisualizer
  - To be familiar with Zoho/ Any reputed CRM Software solution features
  - To customize your application using Zoho/ any reputed CRM Software solutions.
1. Exercises on SQL and PL SQL
  2. Write a script to create a MongoDB database and perform insert operation
  3. Write a MongoDB script to perform query operations
  4. Write a MongoDB Script to perform update operations
  5. Write a MongoDB Script to update documents with aggregation pipeline
  6. Write a MongoDB script to delete single and multiple documents
  7. Write a MongoDB script to perform string aggregation operations
  8. Design a Data Model for MongoDB using DbVisualizer
  9. Perform CRUD operations using DbVisualizer
  10. Create a Zoho/ Any Reputed CRM Software solutions - account and organize your Tasks, Meetings and Deals
  11. Create and maintain a project using Zoho/ Any reputed CRM Software solutions - features

### Course Outcomes

**On the successful completion of the course, students will be able to**

Course Outcome	Description	Knowledge Level
<b>CO1</b>	Comprehend the scripting knowledge in Relational & MongoDB and perform basic operations in shell prompt	<b>K1- K6</b>
<b>CO2</b>	Implement, Create, Read, Update and Delete Operations on Relational & MongoDB database	
<b>CO3</b>	Analyze MongoDB using DbVisualizer	

<b>C04</b>	Assess Zoho/ any reputed CRM features for managing the customer relationships	
<b>C05</b>	Create a customized application in Zoho/ any reputed CRM	

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	S	S	S	S	S	M	S	S	S	M	S	S
C02	S	S	S	S	S	S	S	S	S	S	L	S
C03	S	M	S	S	M	S	M	S	S	S	S	S
C04	S	S	S	M	S	S	S	L	S	S	M	S
C05	S	S	S	S	M	S	S	S	S	S	S	S

**S- Strong; M-Medium; L-Low**

## **Lab – I Architecture and Frameworks - Lab**

### **Course Objectives**

- To understand and implement the basic concepts of Software architecture and its functions.
- To acquire programming skills to develop Implement various technologies and services associated with network protocols along with the challenges of data transfer.
- Implement the importance and functioning of Routing Protocols over communication service.
- To acquire skills to connect two routers and any two switches.
- To comprehend related to SSH protocols and accessing the remote device.

Note: Use the solid servers and client specification for implementation  
<https://github.com/solid/specification/>.

Implement the following using Linux / Windows environments

1. Find the WebID profile document and display the necessary attributes
2. Set and access the primary authentications with account recovery mechanisms
3. Set and access the secondary authentications with account recovery mechanisms
4. Design authorization and web access control
5. Find the content representation
6. Reading resources from HTTP REST API and WebSockets API
7. Writing resources from HTTP REST API and WebSockets API
8. Data notification using Social Web App protocol
9. Managing subscriptions and friends list using Social Web App protocol
10. Managing list of followers and following list using Social Web App protocol

## Course Outcomes

On the successful completion of the course, students will be able to

CO 1	Comprehend the programming skills of Software architecture tools and packages	K1-K6
CO 2	Understand and implement the user profiles and authentication with recovery mechanism.	K1-K6
CO 3	Comprehend and evaluate the access control and content representation use of FTP server	K1-K6
CO4	Understand and implement reading and writing resources for various applications	K1-K6
CO5	Identify and examine the notifications, friends, and follower list of social application protocols.	K1-K6

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

## Mapping Course outcomes with Programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12
CO 1	S	S	M	L	M	S	-	-	-	-	-	-
CO 2	S	M	S	S	S	M	-	-	-	-	-	-
CO 3	S	M	S	M	S	M	-	-	-	-	-	-
CO 4	S	M	L	S	M	L	-	-	-	-	-	-
CO 5	M	S	M	L	S	L	-	-	-	-	-	-

**S- Strong; M-Medium; L-Low**

## Lab – II Python Programming Lab

### Course Objectives:

This course enables the students:

- To master the fundamentals of writing python scripts
- To create program using elementary data items
- To implement Python programs with conditionals and loops
- To use functions for structuring Python programs
- To develop web programming with Django

Implement the following in Python:

1. Program using elementary data items, lists, dictionaries and tuples
2. Program using conditional branches, loops
3. Program using functions
4. Program using classes and objects
5. Program using inheritance
6. Program using polymorphism
7. Program using Numpy
8. Program using Pandas
9. Program using Matplotlib
10. Program for creating dynamic and interactive web pages using forms

### Course Outcomes

**On the successful completion of the course, students will be able to**

<b>CO1</b>	Comprehend the programming skills in python and write scripts	<b>K1- K6</b>
<b>CO2</b>	Create python applications with elementary data items, lists, dictionaries and tuples	
<b>CO3</b>	Implement the Object Oriented Programming programming concepts such as objects and classes, Inheritance and polymorphism	
<b>CO4</b>	Assess the use of Python packages to perform numerical computations and perform data vizualization	
<b>CO5</b>	Create interactive web applications using Django	

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

## Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S
CO3	S	S	S	S	S	S	M	S	S	M	L	S
CO4	S	S	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	L	S	M	S	S	M	M	S

**S- Strong; M-Medium; L-Low**

## Core – IV Data Structures and Algorithms

### Course Objectives:

- To get a clear understanding of various ADT structures.
- To understand how to implement different ADT structures with real-time scenarios.
- To analyze the various data structures with their different implementations.
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern data structures with Python language.

### Unit-I

**Abstract Data Types:** Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays:** Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps- Multi-Dimensional Arrays.

### Unit-II

**Algorithm Analysis:** Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

### Unit-III

**Stacks, Queues, and Deques:** Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

### Unit-IV

**Priority Queues:** Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

### Unit-V

**Search Trees:** Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.



**Text book:**

1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011. (Unit – 1)**Chapters:** 1, 2, 3.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5)**Chapters:** 3 to 12, and 14.

**Reference books:**

1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

**Course Outcome:**

On the successful completion of the course, students will be able to,

CO1	Understand various ADT concepts	K1-K6
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	
CO3	Apply with proper ADT models with problem understanding	
CO4	Apply and Analyze right models based on the problem domain	
CO5	Evaluate modern data structures with Python language	

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

**Mapping with Programme Outcomes:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	S	L	M	M
CO2	S	M	S	M	M	L	L	L	L	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	M	L
CO4	S	S	S	L	L	L	M	M	M	L	L	L
CO5	S	S	S	L	M	M	S	S	S	S	M	L

**L - Low, M- Medium, S - Strong**

## Core –V Big Data Analytics

### Course Objectives

- To introduce big data tools & Information Standard formats.
- To understand the basic concepts of big data.
- To learn Hadoop, HDFS and MapReduce concepts.
- To teach the importance of NoSQL.
- To explore the big data tools such as Hive, HBase and Pig.

### UNIT I

**Big Data and Analytics:** Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data.

Introduction to Big Data: Characteristics – Evolution – Definition – Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop.

Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

### UNIT II

**Technology Landscape:**NoSQL, Comparison of SQL and NoSQL, Hadoop - RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

### UNIT III

**Mongodb and Mapreduce Programming:**MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

### UNIT IV

**Hive:** Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RCFile - Implementation - Hive User Defined Function - Serialization and Deserialization.

## UNIT V

**Pig:** Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

### Text Book:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications, First Edition, 2015

### Reference Book:

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc. (2013)
2. Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, Fourth Edition, 2015
3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications, 2014
4. Robert D.Schneider, "Hadoop For Dummies", John Wiley & Sons, Inc. (2012)
5. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 Chuck Lam, "Hadoop In Action", Dreamtech Publications, 2010

### Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K1-K6
CO2:	To collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.	K1-K6
CO3:	To comprehend, implement and review the concepts of data science and big data analytics projects using MapReduce, and MongoDB	K1-K6
CO4:	To understand, use and analyze the concepts of big data analytics projects using HIVE database.	K1-K6

CO5:	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	K1-K6
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**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create**

**Mapping with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

**S- Strong; M-Medium; L-Low**

## **Core – VI Advanced Computer Networks**

### **Course Objectives**

- Have a detailed knowledge on the concept of networks
- Know the idea on protocols, OSI layers and its functions.
- Get knowledge on protocols used in different layers.
- Know about the function of Internet

### **Unit I**

Introduction- data communications – networks – The internet – Protocols and standards – OSI model – layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media

### **Unit II**

Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing – Flow and error control Multiple access – random access – wired Lan – wireless Lan – Cellulartelephony – satellite networks

### **Unit III**

Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP – Network layer delivery – forwarding – unicast and multicast routing protocols

### **Unit IV**

Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QOS – Techniques to improve QOS

### **Unit V**

Domain name system – name space – domain name space – distribution of name space – DNS in the internet – remote logging - email – file transfer - Network management system – SNMP Protocol

### **Text Book :**

Data communications and networking – Behrouz A Forouzan McGraw Hill 4th Edition 2015reprint

### **Reference Books :**

1. Computer Networks – Tenenbaum -Pearson -2022
2. Computer Networks and Internets -Douglas E. Comer- Pearson 2018.
3. Data and Computer Communications- William Stallings- Pearson Education 2017.
4. Computer networking –Kurose James F, Ross Keith W -Pearson – 2017.

## Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understand fundamental underlying principles of computer networking	K1- K6
CO2	Understand details and functionality of layered network architecture.	K1- K6
CO3	Apply mathematical foundations to solve computational problems in computer networking	K1- K6
CO4	Analyze and evaluate performance of various communication protocols.	K1- K6
CO5	Compare and create new routing algorithms.	K1- K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create**

## Mapping with Programme Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	M	S	L	M	L
CO2	S	M	M	S	M	M	S	L	M	L
CO3	S	S	M	S	S	M	S	M	M	M
CO4	S	S	S	S	S	M	S	M	M	M
CO5	S	S	S	S	S	S	S	M	M	M

**S- Strong; M-Medium; L-Low**

## Elective – III Internet of Things

### a. Course Objectives:

This Course is intended to make the students

1. To understand about the fundamentals of Internet of Things and its building blocks along with their characteristics
2. To understand the recent application domains of IoT in day-to-day life
3. To understand the protocols and standards designed for IoT.
4. To understand the other associated technologies like cloud, fog and Edge computing in the domain of IoT
5. To understand the ongoing developments of **Indian smart cities** project and conceptualize the future needs.

### b. Course Prerequisites:

- Basic Knowledge on Networking and Internet
- Knowledge on wireless and Mobile Technologies
- Fundamental knowledge on problem solving and programming

### c. Course Outcomes (COs):

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

**CO1:** Describe what IoT is and how it works today

**CO2:** Recognise the factors that contributed to the emergence of IoT

**CO3:** Able to apply IoT system design techniques to different paradigms

**CO4 :** Use IoT protocols for communication

**CO5 :** Define the infrastructure requirement for IoT deployments in smart cities

**CO6:** Ability to conceptualize new ideas and present them as intellectual property

### d. Course Outline (Unit wise)

#### Unit I - IOT Basics

(12 Hours)

Genesis of IoT - IoT and Digitization - IoT Impact - Connected Roadways - Connected Factory - Smart Connected Buildings - Smart Creatures - Convergence of IT and OT - IoT Challenges. IoT Network Architecture and Design: Drivers behind New Network Architectures. Scale - Security - Constrained Devices and Networks.

## **Unit II – IOT Architecture reference Models (12 Hours)**

The three layer oneM2M IoT Standardized Architecture - The 7 layer IoT World Forum (IoTWF) Standardized Architecture – Additional reference models – Simplified IOT reference model. Core IOT functional stack. Things layer, Communication layer, Application and analytics layer – IOT data management and Control stack. FOG, Edge and Cloud Computing.

## **Unit III - Smart IOT Objects and communication protocols 12 Hours)**

Sensors, Actuators, MEMS and Smart Objects – Sensor networks and WSN, Communication protocols for wsn. Connecting smart objects: Different Communication criteria – IOT Access technologies: IEEE 802.15.4, *Protocol Stacks Utilizing IEEE 802.15.4*, IEEE 802.15.4g and 802.15.4e: IEEE 1901.2a, IEEE 802.11ah, LoRaWAN, NB-IoT and Other LTE Variations: LTE CAT-0, LTE M, NB-IOT

## **Unit IV - IP and Application Protocols (12 Hours)**

Advantages of IP for IOT, need for Optimization in IP, Optimizing IP for IOT. Application Protocol for IOT: Transport layer, IoT Application Transport Methods, SCADA, CoAP and MQTT - message formats and communication, comparison of CoAP and MQTT.

## **Unit V - IOT Security and Application Case Study (12 Hours)**

A Brief History of OT Security - IOT Security: Challenges- How IT and OT Security Practices and Systems Vary - Formal Risk Analysis Structures: OCTAVE and FAIR. Application Case study: **Smart cities in India** - Introduction to General Characteristics of Smart City Planning Bridging the Gap - Smart City Design and Planning - The intersection of ICT, City Design and City Planning - Benefits of IoT and ICT in Urban Design and Planning. What makes a city smart? - Data-driven Urban Design and Urban Planning - Urban Simulation - Sustainable Urban Planning 5 Smart Cities: Top-down and Bottom-up-Tools for participation - Competency building - Emerging Issues



### e. Mapping of COs to POs and PSOs (To be mapped)

Course Outcome	PO Addressed		Correlation Level		PSO Addressed		Correlation Level		Cognitive Level
	PO1 to PO7		L/M/H		PSO1 to PSO7		L/ M/ H	K <sub>1</sub> to K <sub>6</sub>	
CO1	PO1		M		PSO2		M		K <sub>1</sub> , K <sub>2</sub>
CO2	PO1	PO2	M	H	PSO2		H		K <sub>1</sub>
CO3	PO3	PO4	M	L	PSO2		M		K <sub>2</sub>
CO4	PO3		H	M	PSO4	PSO2	M	L	K <sub>2</sub>
CO5	PO5		M		PSO4		M		K <sub>3</sub>
CO6	PO6	PO7	M	M	PSO5		M		K <sub>5</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create

### g. Reference Books:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things - David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton & Jerome Henry, Cisco Press 2017. (for Unit I to Unit V)
2. Design Planning Smart Cities with IoT/ICT, Release-2.0, DOT, Ministry of Communications, **Govt. of India, January 2019** (Unit V)
3. Introduction to IoT, Cambridge University Press, [SudipMisra](#) , [Anandarup Mukherjee](#) , [Arijit Roy](#), March 2022.
4. Internet of Things A Hands-On Approach by ArshdeepBahga, Vijay Madiseti, Universities press (India) Pvt. Ltd, 2015

## **Elective – III Internet of Things Lab**

### **Course Objectives:**

- To create IoT program to turn ON/OFF LED
  - To implement IoT program for object detection
  - To develop IoT programs for agricultural purpose
  - To create web server program for local hosting
  - To design IoT application for health monitoring
- 
1. To develop an IoT program to turn ON/OFF LED light (3.3V)
  2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)
  3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)
  4. To develop an IoT web server program for local hosting
  5. To develop an IoT program using Soil Moisture Sensor
  6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)
  7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)
  8. To develop an IoT program for Fire Detection (Home, Industry, etc.)
  9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)
  10. To develop an IoMT program using Heartbeat Sensor

## Course Outcomes

On the successful completion of the course, students will be able to,

<b>CO1</b>	Implement IoT programs to turn ON/OFF LED	K1 - K6
<b>CO2</b>	Develop IoT programs for object detection	
<b>CO3</b>	Create IoT programs for agricultural purpose	
<b>CO4</b>	Implement web server program for local hosting	
<b>CO5</b>	Design IoT application for health monitoring	

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

## Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	L	M	S
CO5	S	S	S	S	M	S	L	S	S	M	M	S

S- Strong; M-Medium; L-Low

## Elective – III Computer Vision

### Course Objectives:

- To get understanding about Computer vision techniques behind a wide variety of real- world applications.
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to build a computer vision application with Python language.
- To understand various machine learning techniques that are used in computer vision tasks.
- To incorporate machine learning techniques with computer vision systems.

### Unit-I

**Basic Image Handling and Processing:** PIL – the Python Imaging Library-Matplotlib-NumPy-SciPy-Advanced example: Image de-noising.

**Local Image Descriptors:** Harris corner detector-SIFT - Scale-Invariant Feature Transform-Matching Geotagged Images.

### Unit-II

**Image to Image Mappings:** Homographies-Warping images-Creating Panoramas. **Camera Models and Augmented Reality:** The Pin-hole Camera Model-Camera Calibration-Pose Estimation from Planes and Markers-Augmented Reality.

### Unit-III

**Multiple View Geometry:** Epipolar Geometry-Computing with Cameras and 3D Structure-Multiple View Reconstruction-Stereo Images. **Clustering Images:** K-means Clustering-Hierarchical Clustering-Spectral Clustering.

### Unit-IV

**Searching Images:** Content based Image Retrieval-Visual Words-Indexing Images- Searching the Database for Images-Ranking Results using Geometry-Building Demos and Web Applications. **Classifying Image Content:** K-Nearest Neighbors-Bayes Classifier-Support Vector Machines-Optical Character Recognition.

### Unit-V

**Image Segmentation:** Graph Cuts-Segmentation using Clustering-Variational Methods. **OpenCV:** Python Interface-OpenCV Basics-Processing Video-Tracking.

**Course Outcome:**

On the successful completion of the course, students will be able to,

CO1	To understand and recall computer vision and its application areas	K1-K6
CO2	To develop build a computer vision system	
CO3	To apply and analyze a design range of algorithms for image processing and computer vision	
CO4	To develop incorporate machine learning techniques with computer vision system	
CO5	To apply and analyze image segmentation and image registration	

**K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create**

**Mapping with Programme Outcomes:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	L	L	L	M	M	M	S	S	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	M	L
CO4	S	S	S	M	M	L	M	L	M	L	S	L
CO5	S	S	S	M	M	L	S	L	S	L	S	L

**L - Low, M- Medium, S - Strong**

## **Elective – III Computer Vision Lab**

### **Course Objectives:**

- To get an idea of how to build a computer vision application with Python language.
- To learn the basic image handling and processing
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to implement the image transforms.
- To understand various image segmentation algorithms.

Implement the following problems using Python with OpenCV

1. Image Loading, Exploring, and displaying an Image.
2. Access and Manipulate of Image Pixels.
3. Image Transformations.
  - i) Resizing
  - ii) Rotation
4. Addition operation of Two Images.
5. Image filtering operations
  - i) Mean Filtering
  - ii) Gaussian Filtering
6. Image Binarization Using Simple Thresholding method.
7. Edge Detection operation using Sobel and Scharr Gradients.
8. Find Grayscale and RGB Histograms of an Image.
9. Segment an Image using K-means Clustering algorithm.
10. Write a program to classify an Image using KNN Classification algorithm.

**Course Outcome:**

On the successful completion of the course, students will be able to,

CO1	To develop and implement the image loading and exploring	K1-K6
CO2	To Evaluate the image transforms	
CO3	To apply and analyze for image processing denoising algorithms	
CO4	To design and develop the Image Segmentation using Edge	
CO5	To apply and analyze image clustering and classification algorithms	

**K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create**

**Mapping with Programme Outcomes:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	L	L	L	M	M	M	S	S	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	M	L
CO4	S	S	S	M	M	L	M	L	M	L	S	L
CO5	S	S	S	M	M	L	S	L	S	L	S	L

L - Low, M- Medium, S - Strong

## **Elective – IV Cyber Security**

### **Course Objectives:**

- To understand the basics of Cybercrime and Computer forensics with protecting mechanism
- To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines
- To gain the ability to understand the importance of cyber investigations with its functioning role and learn the basics of Wi Fi and its security measures
- To understand and learn the method of seize the digital evidence
- To learn and analyze the concepts of digital forensics with cybercrime prevention techniques

### **Unit – I**

Introduction to cybercrime: Classification of cybercrimes – reasons for commission of cybercrime – malware and its type – kinds of cybercrime – authentication – encryption – digital signatures – antivirus – firewall – steganography – computer forensics – why should we report cybercrime – introduction counter cyber security initiatives in India – generating secure password – using password manager-enabling two-step verification – security computer using free antivirus.

### **Unit – II**

Tips for buying online: Clearing cache for browsers – wireless LAN-major issues with WLAN-safe browsing guidelines for social networking sites – email security tips – introduction-smartphone security guidelines – purses, wallets, smart phones – platforms, setup and installation-communicating securely with a smartphone.

### **Unit – III**

Cyber investigation roles: Introduction – role as a cybercrime investigator – the role of law enforcement officers – the role of the prosecuting attorney – incident response: introduction-post mortem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting Wi-Fi transmission – Wi-Fi technology – Wi-Fi RF-scanning RF – eavesdropping on Wi-Fi – fourth amendment expectation of privacy in WLAN.

### **Unit – IV**

Seizure of digital information: introduction – defining digital evidence –



digital evidence seizure methodology – factors limiting the wholesale seizure of hardware – other options for seizing digital evidence – common threads within digital evidence seizure – determining the most appropriate seizure method– conducting cyber investigations–demystifying computer/cyber crime – IP addresses – the explosion of networking – interpersonal communication.

**Unit – V**

Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases of digital forensics-collection – examination-analysis – reporting – Cyber crime prevention: Introduction – crime targeted at a government agency.

**Text books:**

1. Dr.JeetendraPande, "Introduction to Cyber Security" Published by Uttarakhand Open University, 2017.(Chapter: 1.2-6.4,9.3-12.2)
2. Anthony reyes, Kevin o’shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thomas Ralph, "Cyber-crime investigations" - bridging the gaps between security professionals, law enforcement, and prosecutors, 2007.(Chapter: 4, 5, 6, 7, 8, 9,10)

**Reference Books:**

1. Sebastian Klipper, "Cyber Security" EinEinblickfurWirtschaftswissenschaftlerFachmedien Wiesbaden,2015
2. John G.Voller Black and Veatch, "Cyber Security" Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada ©2014.

**Course Outcomes**

On the successful completion of the course, students will be able to

CO1 :	Understand, describe, analyze and examine the basics of Cyber security concepts and its implementation in India	K1- K6
CO2 :	Comprehend and demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem andForensics	K1- K6
CO3 :	Understand, apply and evaluate the various investigation roles and Wi Fi protecting mechanisms.	K1- K6

CO4 :	Understand, illustrate and evaluate the method of seize the digital information and evidences forensics data and evaluate the forensics reports	K1- K6
CO5 :	Comprehend, apply and appraise the methods digital forensics with cybercrime prevention techniques	K1- K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

	PO 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12
CO 1	S	L	-	L	M	L	M	M	-	M	-	-
CO 2	M	S	-	L	M	L	M	M	-	M	-	-
CO 3	M	S	L	L	M	L	M	M	-	M	M	L
CO4	S	M	L	S	M	L	S	M	-	M	-	-
CO5	M	S	M	L	S	L	M	S	-	S	-	-

**S- Strong; M-Medium; L-Low**

## Elective – IV Cyber Security Lab

### COURSE OBJECTIVES

- To learn and implement to Change the wireless device mode as monitor mode
- To develop in multiple vulnerabilities webserver
- To understand and implement the open ports in the network
- To acquire programming skills in Implement various wireless device modes
- To comprehend related to find the sub domains of webpage

Implement the following using any cyber security tools

1. Install virtual box (kali Linux)
2. Generate a secure password using keepass
3. Change the wireless device mode as monitor mode
4. Find the known and open vulnerabilities of system using metasploit
5. Identify the multiple vulnerabilities webserver using nikto tool
6. Identify the open ports in the network using nmap tools
7. List all the network around us and display the information about the networks
8. Sniff and capture the packet sent over HTTP requests
9. Find the owners of internet resources using Whois Lookup tool
10. Find the subdomains of webpage using knock tool

### Course Outcomes

On the successful completion of the course, students will be able to

CO1 :	Comprehend the programming skills in Change the wireless device mode as monitor mode	K1-K6
CO2 :	Understand and implement multiple vulnerabilities webserver	K1-K6
CO3 .	Evaluate the use of different wireless device modes	K1-K6
CO4:	Design to Solve related to find the subdomains of webpage	K1-K6
CO5:	Create and apply open ports in the network	K1-K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create**

## Mapping Course outcomes with Programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1	S	-	-	-	-	L	-	-	-	-	-	-
CO 2	S	-	M	-	M	L	-	-	-	-	-	-
CO 3	S	-	S	-	S	L	-	-	-	S	S	S
CO 4	S	-	S	-	S	L	-	-	-	S	S	S
CO 5	S	-	S	-	S	L	-	-	-	S	S	S

**S- Strong; M-Medium; L-Low**

## Elective – IV Blockchain Technologies

### COURSE OBJECTIVES

- To understand about Blockchain is an emerging technology platform for developing decentralized applications and data storage.
- To comprehend fundamentals of Public Key Cryptography technology and Consensus Algorithms.
- To familiarize with Bitcoin Network, Bitcoin Clients, APIs and Payment technology of blockchain operations.
- To engage with Components of the Ethereum ecosystem.
- To grasp about Development Tools and Frameworks.

### Unit I: Blockchain, Decentralization

**Blockchain** :The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Blockchain - Consensus - CAP theorem and blockchain. **Decentralization**: Decentralization using blockchain - Methods of decentralization -Routes to decentralization - Blockchain and full ecosystem decentralization - Pertinent terminology - Platforms for decentralization - Innovative trends.

### Unit II: Public Key Cryptography, Consensus Algorithms and Smart Contracts

**Public Key Cryptography**: Asymmetric cryptography - Cryptographic constructs and blockchain technology. **Consensus Algorithms**: Introducing the consensus problem -Analysis and design - Classification - Algorithms - Choosing an algorithm. **Smart Contracts**: History - Definition - Ricardian contracts - Smart contract templates - Oracles - Deploying smart contracts - DAO

### Unit III: Bitcoin

**Bitcoin**: Bitcoin—an overview - Cryptographic keys - Transactions - Blockchain - Mining. **Bitcoin Network and Payments**: The Bitcoin network - Wallets - Bitcoin payments -Innovation in Bitcoin - Advanced protocols - Bitcoin investment and buying and selling Bitcoin. **Bitcoin Clients and APIs**: Bitcoin client installation - Experimenting further with bitcoin-cli - Bitcoin programming.

### Unit IV: Alternative Coins

**Alternative Coins**: Theoretical foundations - Difficulty adjustment and retargeting algorithms - Bitcoin limitations - Extended protocols on top of Bitcoin -Development of altcoins.**Ethereum**: **Ethereum** – an overview -

Ethereum network - Components of the Ethereum ecosystem - EthereumVirtual Machine (EVM) - Smart contracts. - Blocks and blockchain - Wallets and client - Nodes and miners - APIs, tools, and DApps - Supporting protocols - Programming languages.

## **Unit V: Development Tools and Frameworks, Use Cases & Security**

**Development Tools and Frameworks** :Languages - Compilers - Tools and libraries - Frameworks - Contract development and deployment - Layout of a Solidity source code file - Solidity language. **Use Cases:** IoT – Government - Health -Finance – Media. **Scalability and Other Challenges:** Scalability - Privacy - Security - Other challenges.

### **TEXT BOOKS**

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies. Princeton University Press, 2016. ISBN 978-0691171692

### **REFERENCES**

Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. Oreilly Publishers, 2017. ISBN 978-9352135745

### **Course Outcomes**

On the successful completion of the course, students will be able to

CO 1:	Understand, apply and examine the characteristics of blockchain,bitcoin and consensus algorithm in centralized and decentralized methods.	K1-K6
CO 2:	Comprehend and demonstrate the application of hashing and public key cryptography in protecting the blockchain.	K1-K6
CO 3:	Understand and analyse the elements of trust in a Blockchain: validation, verification, and consensus.	K1-K6
CO4	Comprehend and evaluate the alternate coin, Ethereum and smart contract.	K1-K6
CO5	Grasp and apply the knowledge of Tools and languages for applications	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5-Evaluate, K6- Create

### **Mapping Course outcomes with Programme outcomes**

CO s	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12
CO 1	S	-	-	-	-	L	-	-	-	-	-	-
CO 2	S	-	M	-	M	L	-	-	-	-	-	-

CO 3	S	-	S	-	S	L	-	-	-	S	S	S
CO 4	S	-	S	-	S	L	-	-	-	S	S	S
CO 5	S	-	S	-	S	L	-	-	-	S	S	S

**S- Strong; M-Medium; L-Low**

## **Elective – IV Blockchain Technologies Lab**

### **Course Objectives**

- To learn the basics of Blockchain and apply cryptographic algorithms
- To design, build, and deploy smart contracts and distributed applications,
- To deploy Private Blockchain and smart contracts on Ethereum.
- To understand and deploy cryptocurrencies and their functions in applications
- To implement Blockchain for various use cases.

### **Implement the following**

1. Create a Public Ledger and Private Ledger with the various attributes like Access, Network Actors, Native token, Security, Speed and examples.
2. Building and Deploying MultiChain private Blockchain
3. Write Hello World smart contract in a higher programming language (Solidity)
4. Construct the Naïve block chain
5. Construct and deploy your contract (Use deploy method)
6. Set up a Regtest environment
7. Build a payment request URI
8. Hashcash implementation
9. Develop a toy application using Blockchain
10. Create simple wallet transaction from one account to another account using Metamask.



## Course Outcomes

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

CO1:	Enable to setup your own private Blockchain and deploy smart contracts on Ethereum.	K1-K6
CO2:	Gains familiarity and implement with cryptography and Consensus algorithms.	K1-K6
CO3:	Create and deploy projects using Web3j.	K1-K6
CO4:	Recall and deploy the structure and mechanism of Bitcoin, Ethereum, Hyperledger	K1-K6
CO5:	Implement Blockchain for various use cases	K1-K6

## Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	L	M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-
CO4	S	M	L	S	M	L	-	-	-	-	-	-
CO5	M	S	M	L	S	L	-	-	-	-	-	-

S – Strong, M – Medium, L - Low

## Lab – III Data Structures and Algorithms Lab

### Course Objectives:

- To understand Stack , Queue and Doubly Linked ADT structures.
- To implement different ADT structures with real-time scenarios.
- To analyze the recursion concepts.
- To apply different sorting and tree techniques.
- To implement modern data structures with Python language.

### Implement the following problems using Python 3.4 and above

1. Recursion concepts.
  - i) Linear recursion
  - ii) Binary recursion.
2. Stack ADT.
3. Queue ADT.
4. Doubly Linked List ADT.
5. Heaps using Priority Queues.
6. Merge sort.
7. Quick sort.
8. Binary Search Tree.
9. Minimum Spanning Tree.
10. Depth First Search Tree traversal.

### Course Outcome:

On the successful completion of the course, students will be able to,

CO1	Strong understanding in various ADT concepts	K1-K6
CO2	To become a familiar with implementation of ADT models	
CO3	Apply sort and tree search algorithms	
CO4	Evaluate the different data structure models	

CO5	Learn how to develop ADT for the various real-time problems	
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K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

**Mapping with Programme Outcomes:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	M	M	S	S
CO2	S	M	S	M	M	L	S	M	S	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	S	L
CO4	S	S	S	M	M	S	M	M	S	S	S	L
CO5	S	S	S	S	L	M	S	M	M	M	M	L

**L - Low, M- Medium, S - Strong**

## **Lab – IV Big Data Analytics Lab**

### **Course Objectives**

- To teach the fundamental techniques for handling the big data tools.
- To familiarize the tools required to manage big data.
- To analyse big data using Hadoop, MapReduce, Hive, and Pig
- To teach the fundamental principles in achieving big data analytics with scalability and streaming capability
- To enable students to have skills that will help them to solve complex.

### **List of Programs**

1. Implement File System Shell Commands for HDFS in Hadoop Environment
2. Write a Mapreduce program using single reduce function for finding Maximum and Minimum Number
3. Write a Mapreduce program using multiple reduce function for Word Count in an given Text document
4. Implement the following using Pig Latin Input and Output Operations Relational Operations
5. Implement the following using Pig Latin User Defined Functions Advanced Relational Operations
6. Write a Word Count program using Pig Latin Script
7. Write a program to find a maximum temperature using Pig Latin Script
8. Implement the following using Hive commands Handling the Database Creating and Manipulating table
9. Implement Simple Queries for database using Mongo
10. Implement Simple Queries for collections using Mongo

## Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand and develop conceptually how Big Data is stored and implement it using different tools	K1-K6
CO2:	Comprehend and implement programs for data storage in HDFS and table manipulation using Big Data tools in Hadoop environment	K1-K6
CO3:	Understand and Critically analyse existing Big Datadatasets and implementations the solutions for it using MongoDB	K1- K6
CO4:	Understand and examine existing Big Datadatasets and implementations the solutions using HIVE database	K1- K6
CO5:	Comprehend and review existing datasets and implementations the solutions to handle it using PIG	K1- K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create**

## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M		M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-
CO4	S	M	S	S	S	M	-	-	-	-	-	-
CO5	S	S	S	S	S	S	-	-	-	-	-	-

**S- Strong; M-Medium; L-Low**

# Core VII Advanced Java Programming

## Course Objectives

- To gain knowledge of Object Oriented Programming Concept in Java
- To understand usages of String functions in Java
- To familiarize with the applet and swing
- To grasp the concepts on Java Beans
- To comprehend the connection between Relational Database and Java.

## Unit – I

An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays: Primitive Types-Literals Variables - Type Conversion and Casting- Arrays-Operators: Control Statements-Classes and Methods - Inheritance- Exception Handling.

## Unit – II

String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces - File - Byte Streams - Character Streams.

## Unit – III

The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window - Passing Parameters. Introducing GUI Programming with Swing- Introducing Swing - Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.

## Unit- IV

Java Beans: Introduction - Advantages of Beans - Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.

## Unit – V

Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows - Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.

## Text Books:

1. Herbert Schildt, "Java the Complete Reference", 10<sup>th</sup> edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goddis, "Starting out with Java from Control Structures Through Objects" 6th Edition, Pearson Education Limited, 2016

## Reference books :

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013
2. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi, 2012.

## Course Outcomes

**On the successful completion of the course, students will be able**

CO1:	Understand the Object Oriented Program including classes and methods; inheritance and exception handling	K1-K6
CO2:	Complete comprehension of String functions and I/O Streams	K1-K6
CO3:	Creation of graphical representation using Applet	K1-K6
CO4:	Application of Servlets for designing Web based applications	K1- K6
CO5:	Usage of JDBC connectivity and implementation of the concept to get desired results from database	K1-K6

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

## Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	M	S	-	-	-	S	M	-
CO2	S	S	S	-	M	S	-	-	-	L	M	-
CO3	S	S	M	-	L	S	-	-	-	M	M	-
CO4	M	S	M	-	S	S	-	-	-	M	S	-
CO5	S	M	M	-	M	L	-	-	-	M	M	-

**S- Strong; M-Medium; L-Low**

## Core VIII Web Technologies

### COURSE OBJECTIVES:

- Understand the fundamentals of the web and thereby develop web applications using various development languages and tools.
- Enrich knowledge about XHTML control and Cascading Style Sheets.
- Provide in- depth knowledge about Javascript.
- To enhance knowledge in XML documents with presentations using CSS and XSLT.
- Deliver depth knowledge about PHP, Angular JS, JQuery.

### UNIT -I

**WEB FUNDAMENTALS AND HTML:** A Brief Introduction to the Internet - The World Wide Web - Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element

### UNIT – II

**INTRODUCTION TO XHTML AND CSS:** Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML-Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The<span> and <div>tags, Conflict resolution.

### UNIT - III

**THE BASICS OF JAVASCRIPT:** Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts.

**JAVASCRIPT AND XHTML DOCUMENTS:** The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script,



Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model

#### **UNIT- IV**

DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.

#### **UNIT - V**

**PHP, ANGULAR JS AND JQUERY:** Introduction to PHP: Overview of PHP -General Syntactic Characteristics - Primitives, Operations, and Expressions - Output - Control Statements - Arrays - Functions - Pattern Matching - Form Handling - Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.

#### **TEXT BOOKS:**

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. **UNITS:** 1,2,3,4
2. Dayley Brad, Dayley Brendan , "AngularJS, JavaScript, and jQuery All in One", Sams Teach Yourself 1st Edition, Kindle Edition, 2015.**UNIT:** 5

#### **REFERENCE BOOKS:**

1. M. Srinivasan: Web Programming Building Internet Applications, 3<sup>rd</sup>Edition, Wiley India, 2009.
2. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7<sup>th</sup>Impression,2012.

3. Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.

### **COURSE OUTCOMES:**

On the successful completion of the course, students will be able

CO1	Design dynamic web pages using Javascript, JQuery and Angular Java script	K1	LO
CO2	Develop Web pages using HTML, CSS and XML	K2	IO
CO3	Create web application using PHP and MySQL	K3, K4	HO
CO4	To design dynamic web pages using Angular javascript	K2,K3	HO
CO5	Develop interactive web pages using JQuery	K4,K5	HO

### **MAPPING WITH PROGRAMME OUTCOMES**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	S	S	M	M	S	M	M	S	S
CO2	S	S	M	S	S	S	M	S	S	S	S	S
CO3	S	S	S	M	S	S	M	M	S	M	M	S
CO4	S	S	S	M	S	M	M	S	S	M	S	M
CO5	S	S	S	M	S	S	M	S	M	S	S	M

**S- STRONG; M-MEDIUM; L-LOW**

## Core IX Advanced Machine Learning

### Course Objectives

- To understand the concepts of Machine Learning.
- To understand the theoretical and practical aspects of types of machine learning
- To teach and get familiarized with supervised learning and their applications.
- To teach and get familiarized with the concepts and algorithms of unsupervised learning.
- To appreciate the concepts and algorithms of deep learning.

### Unit I:

**Introducing Machine Learning:** The Origins of Machine Learning, Uses and Abuses of Machine Learning \_ Basics of Machine Learning Algorithm Model Works - Steps to apply Machine Learning - Choosing a Machine Learning Algorithm - Using Machine Learning concepts.

**Managing and Understanding Data:** Data Structures, Vectors And Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.

### Unit II:

Lazy Learning – **Classification Using Nearest Neighbors:** The kNN Algorithm- Diagnosing Breast Cancer with the kNN Algorithm- Probabilistic Learning – Classification Using Naive Bayes: Basic concepts of Bayesian Methods- The Naïve Bayes Algorithm- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm.

Divide and Conquer – **Classification Using Decision Trees and Rules:** Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.

### Unit III:

Forecasting Numeric Data – **Regression Methods:** Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees.

Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Backpropagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns - Market Basket Analysis Using Association Rules: Understanding Association Rules- Example - Identifying Frequently Purchased Groceries with Association Rules.

#### **Unit IV:**

Finding Groups of Data - **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- Beyond Accuracy - other Measures of Performance, Visualizing Performance Tradeoffs.

Improving Model Performance: Tuning Stock Models for Better Performance- Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process- Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting- Random forests.

#### **Unit V:**

**Introduction to Deep Learning:** Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Restricted Boltzmann Machines (RBMs).

**Convolutional Neural Networks (CNNs):** Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization- Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back-Propagation Through Time (BPPT)- Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs - Structural Damping Within RNNs, Tuning Parameter Update Algorithm.

## **Text Books:**

1. Brett Lantz, "Machine Learning with R", Addison-Wesley Packt Publishing, 2013.
2. TawehBeysolow, "Introduction to Deep Learning Using R: A Step-by-Step Guide to Learning and Implementing Deep Learning Models Using R", San Francisco, California, USA, 2017.

## **Reference Books:**

1. Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics", Second Ed., Wiley Publication, 2015.
2. Bertt Lantz, "Machine Learning with R: Expert techniques for predictive modeling", 3rd Edition, April 15, 2019,
3. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals", Wiley Publication, 2015.

## **Course Outcomes**

### **On the successful completion of the course, students will be able to**

CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data	<b>K1-K6</b>
CO2	To comprehend, apply and evaluate the classification techniques for real-world applications	<b>K1-K6</b>
CO3	To understand, use and perform evaluation of Regression methods	<b>K1-K6</b>
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	<b>K1-K6</b>
CO5	To understand, identify, implement and review the deep learning techniques for real-time applications	<b>K1-K6</b>

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	S	S	-	-	S	L	-	S	-	-	-	-
C02	S	S	M	-	S	L	-	S	-	-	-	-
C03	S	S	S	-	S	L	-	S	-	S	S	S
C04	S	S	M	-	S	L	-	S	-	-	-	-
C05	S	S	S	-	S	L	-	S	-	S	S	S

**S- Strong; M-Medium; L-Low**

## **Elective –V Industry Dynamics Technology-Data Visualizations**

### **Course Objectives:**

- To understand the various types of data, apply and evaluate the principles of data visualization.
- Acquire skills to apply visualization techniques to a problem and its associated dataset.
- To apply structured approach to create effective visualizations.
- To learn how to bring valuable insight from the massive dataset using visualization.
- To learn how to build visualization dashboard to support decision making.

### **UNIT I: Introduction to data visualization**

Overview of data visualization – Data Abstraction- Task Abstraction – Analysis: Four levels for Validation.

### **UNIT II: Visualization Techniques:**

Scalar and Point Techniques – Vector Visualization techniques – Multidimensional techniques – Visualizing Cluster Analysis – Matrix Visualization in Bayesian Data Analysis.

### **UNIT III: Visual Analytics:**

Networks and Trees – Heat Map – Map Color and other channels – Manipulate View and Visual Attributes.

### **UNIT IV: Visualization Tools & Techniques:**

Introduction to various data visualization tools – Visualization using R. Diverse types of Visual Analysis:

Times – Series data Visualization – Text data Visualization – Multivariate data Visualization and Case studies.

### **UNIT V: Integration of Data Visualization with Hadoop:**

Integration of Visualization tools with Hadoop.

Visualization Dashboard Creations:

Dashboard creation using visualization tools for the use cases: Finance-Marketing-Insurance –Healthcare etc.,

### **Text Books:**

1. Tamara Munzer, Visualization Analysis and Design -, CRC Press 2014
2. Stephen Few, Now You See It -, Analytics Press, 2009

### Reference Books:

1. Dr.Chun-hauh Chen, W.K.Hardle,A.Unwin, Handbook of Data Visualization, Springer publication,2008
2. Ben Fry, Visualizing Data -, O'Reilly Media, 2008
3. John Verzani, Simpler- Using R for introductory statistics, Taylor&Francis, 2005
4. A little book of R for multivariate analysis-Avril Coghlan, 2013

Course Outcomes:

After successfully completing the course the student should be able to

CO1	Identify the different data types, visualization types to bring out the insight.	K1-K6
CO2	Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.	K1-K6
CO3	Design visualization dashboard to support the decision making on large scale Data.	K1-K6
CO4	Demonstrate the analysis of large dataset using various visualization techniques and tools.	K1-K6

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create**

### Mapping with Programme Outcomes

CO1	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2	S	-	-	-	-	L	-	-	-	-	-	-
CO3	S	-	M	-	M	L	-	-	-	-	-	-
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S
CO6	S	-	S	-	S	L	-	-	-	S	S	S

**S- Strong; M-Medium; L-Low**



## **Elective –V Mobile Application Development**

### a) COURSE OBJECTIVES:

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution

### b) COURSE OUTCOME:

Upon the students will be able to Completion of the course,

1. Describe the requirements for mobile applications
2. Explain the challenges in mobile application design and development
3. Develop design for mobile applications for specific requirements
4. Implement the design using Android SDK
5. Implement the design using Objective C and iOS
6. Deploy mobile applications in Android and iPhone mark at place for distribution

### c) COURSE PREREQUISITE:

Should have knowledge of Android Application, and wireless networks.

### **e. Course Outline:**

#### **UNIT I:**

**15 hours**

Introduction: Introduction to Mobile Computing – Introduction to – Android Development Environment -Factors in Developing Mobile Applications: Mobile Software Engineering – Frameworks and Tools – Generic UI Development – Android User.

#### **UNIT II**

**15 hours**

More on UIs: VUIs and Mobile Apps – Text-to-Speech Techniques – Designing the Right UI – Multichannel and Multimodal UIs – Intents and Services: Android Intents and Services – Characteristics of Mobile Applications – Successful Mobile Development.

### UNIT III

15 hours

Storing and Retrieving Data: Synchronization and Replication of Mobile Data – Getting the Model Right – Android Storing and Retrieving Data – Working with a Content Provider – Communications Via Network and the Web: State Machine – Correct Communications Model – Android Networking and Web

### UNIT IV

15 hours

Telephony: Deciding Scope of an App – Wireless Connectivity and Mobile Apps – Android Telephony – Notifications and Alarms: Performance – Performance and Memory Management – Android Notifications and Alarms.

### UNIT V

15 hours

Graphics: Performance and Multithreading – Graphics and UI Performance – Android Graphics and - Multimedia: Mobile Agents and Peer-to-Peer Architecture – Android Multimedia – Location: Mobility and Location Based Services.

#### f. Mapping of COs to POs and PSOs

Course Outcome	PO Addressed PO1 to PO7		Correlation Level L/M/H		PSO Addressed PSO1 to PSO7		Correlation Level L/ M/ H		Cognitive Level K <sub>1</sub> to K <sub>6</sub>
CO1	PO1		H		PSO3		L		K <sub>1</sub>
CO2	PO2	PO3	M	M	PSO1	PSO4	M	H	K <sub>2</sub>
CO3	PO2	PO4	H	M	PSO1	PSO2	H	H	K <sub>3</sub>
CO4	PO1	PO5	H	M	PSO1		H		K <sub>4</sub>
CO5	PO4		H		PSO6		M		K <sub>5</sub>
CO6	PO6	PO7	H	H	PSO6		H		K <sub>6</sub>

#### g. Reference books

1. G. Luger, W. A. Stubblefield, "Artificial Intelligence", Third Edition, Addison – Wesley Longman, 1998.
2. N. J Nilsson, "Principles of Artificial Intelligence". Narosa Publishing House, 1980.

## **Elective –VI Social Networks**

### **Course Objectives**

- To learn about Social media, Social networking and Webcasts
- To understand and build a Word Press Powered Website
- To analyze Micro-Blogging and Social Networking
- To learn and analyze the Widgets & Badges
- To explore the importance of Website optimization

### **Syllabus**

**UNIT I:** Introduction: Social Media Strategy-Important First Decisions - Websites, Blogs - RSS Feeds Mapping -Preparation - Multimedia Items Gathering Content for Blog Posts RSS Feeds & Blogs-RSS Feeds-The Feed Reader-The Feed-Options for Creating an RSS Feed-Planning Feed-Blogs-Options for Starting. Blog and RSS Feed-Feed or Blog Content-Search Engine Optimization (SEO)-Feed Burner-RSS Feed and Blog Directories-An Optimization Plan for Blog or RSS Feed

**UNIT II:** Building a Word Press Powered Website: Word Press as A CMS - Diversity of Word Press Sites-The Anatomy of a Word Press Site -a Brief Look at the Word Press Dashboard Planning - Site Themes Plug-ins setting up Sidebars Building Pages- Posting Blog Entries. Podcasting, Vidcasting, & Webcasting- Publishing Options for Podcast- Creating and Uploading Podcast Episodes-Publishing Podcast Optimizing Podcast- Webcasting

**UNIT III:** Social Networking & Micro-Blogging: Facebook-The Facebook Profile -Myspace LinkedIn-Twitter-Niche Social Networking Sites-Creating Own Social Network-Promoting Social Networking Presence- Social Bookmarking & Crowd-Sourcing - Social Bookmarking-A Social Bookmarking Strategy- Crowd-Sourced News Sites- Preparation And Tracking Progress Media Communities-Image Sharing Sites-Image Sharing Strategy-Video Sharing Sites-Video Sharing Strategy-Searching And Search Engine Placement-Connecting With Others.

**UNIT IV:** Widgets & Badges: Highlighting Social Web Presence-Sharing And Syndicating Content Making Site More Interactive-Promoting Products And Making Money-Using Widgets In Word Press-Widget Communities And Directories- Working Widgets Into Strategy Social Media Newsrooms-Building Social Media Newsroom - Populating The Newsroom-Social Media News Releases-Social Media Newsroom Examples. More Social Tools-Social Calendars-Social Pages Wikis-Social Search Portals-Virtual Worlds.

**Unit V:** Website optimization: A Website Optimization Plan-Streamlining Web Presence-An Integration Plan- Looking to the Future-Life streaming:

The Future of Blogging-Distributed Social Networking-Social Ranking, Relevancy, and –Defriending-Web 3.0 or The Semantic Web-Mobile Technology- Measuring Your Success-A Qualitative Framework-A Quantitative Framework-Tools to Help You Measure-Come To Your Own Conclusions

**Text Book:**

1. Deltina hay –A Survival Guide To social Media and Web 2.0 Optimizationll, Dalton Publishing, 2009

**Reference Books:**

1. Miriam Salpeter –Social Networking for Career Successll Learning Express, 2011.
2. Miles, Peggy, –Internet world guide to webcastingll Wiley, 2008 Professionals”, Wiley Publication,2015.

**Course Outcomes**

On the successful completion of the course, students will be able to

CO1:	To understand, impart and summarize the concepts of Social media, Social networking and Webcasts	K1-K6
CO2:	To comprehend, design and develop a Word Press Powered Website	K1-K6
CO3:	To understand, implement and perform evaluation of Social Networking and Micro-Blogging	K1-K6
CO4	To collaborate, implement and analyse the Widgets and Badges in social networking environment	K1-K6
CO5	To understand, illustrate and perform evaluation of web optimization for social networks	K1-K6

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	L	-	S	-	S	S	S
CO2	S	S	S	-	S	L	-	S	-	S	S	S
CO3	S	S	S	-	S	L	-	S	-	S	S	S
CO4	S	S	S	-	S	L	-	S	-	S	S	S
CO5	S	S	S	-	S	L	-	S	-	S	S	S

**S- Strong; M-Medium; L-Low**

## Elective –VI High Performance Computing

### Course Objectives:

- To get a clear idea of High Performance Computing concept.
- To get brief knowledge about how to function the HPC systems.
- To get idea of what techniques used in HPC models.
- To understand a Parallel computing concepts.
- To get familiar with OpenMP technology that is widely used in HPC technology.

### Unit-I

**Modern processors:** Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multicore processors-Multithreaded processors-Vector processors. **Basic optimization techniques for serial code:** Scalar profiling-Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.

### Unit-II

**Data access optimization:** Balance analysis and light speed estimates-Storage order-Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix-vector multiply. **Parallel computers:** Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers-Hierarchical systems-Networks.

### Unit-III

**Basics of parallelization:** Introduction to Parallelism -Parallel scalability. **Shared memory parallel programming with OpenMP:** Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.

### Unit-IV

**Efficient OpenMP programming:** Profiling OpenMP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. **Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.

### Unit-V

**Distributed-memory parallel programming with MPI:** Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. **Efficient MPI programming:** MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication

overhead-Understanding intranode point-to-point communication.

**Text book:**

1. Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011.**Chapters:** 1 to 10.

**Reference books:**

1. Michael W. Berry, Kyle A. Gallivan, Efstratios Gallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

**Course Outcome:**

On the successful completion of the course, students will be able to,

CO1	Understand of the HPC and ccNUMA concepts	K1 - K6
CO2	Design and develop a parallel programming with modern C, C++ and new version of FORTRAN	
CO3	Apply with parallel computing	
CO4	Develop an efficient OpenMP programming	
CO5	Evaluate an efficient MPI programming	

**K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create**

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	L	L	L	S	S	S	S	M	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	S	L
CO4	S	S	S	M	S	L	M	L	M	S	S	S
CO5	S	S	S	M	M	L	M	M	M	M	S	L

**L - Low, M- Medium, S - Strong**

## Lab –V Advanced Java Programming Lab

### COURSE OBJECTIVES:

- To implement object oriented concepts in JAVA
- Develop the program using concepts Network programme
- Learn how to create a program in java beans.
- Learn how to connect relational database to Java
- Develop the program using concepts Applet

### List of Experiments:

1. Implementation of and Exception handling concepts with different type of Exception.
2. Build a Swing application to implement metric conversion.
3. Use Grid Layout to design a calculator and simulate the functions of a simple calculator.
4. Create a Color palette with a matrix of buttons using Applet.
5. To invoke a servlet from HTML forms.
6. To invoke servlet from Applets.
7. To invoke servlet from JSP.
8. Implement message communication using Network Programming.
9. Write a program to connect databases using JDBC.
10. Implementation of Java Beans.

### Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Implement classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem	K1, K2	LO
CO2:	Apply Applets and Swing programs	K3	IO
CO3:	Develop Servlets and JSP for creating Web based applications using JDBC	K4, K5	HO

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												

**S- Strong; M-Medium; L-Low**