



# AVS

## COLLEGE OF ARTS & SCIENCE

### (AUTONOMOUS)

Attur Main Road, Ramalingapuram, Salem - 106.

(Recognized under section 2(f) & 12(B) of UGC Act 1956 and

Accredited by NAAC with 'A' Grade)

(Co - Educational Institution | Affiliated to Periyar University, Salem

ISO 9001 : 2015 Certified Institution)

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Syllabus for

## MCA

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK

(CBCS – LOCF)

(Applicable to the Candidates admitted from 2023-24 onwards)

## VISION

- To attain excellence in the field of education by creating competent scholars with a touch of human values.

## MISSION

- To accomplish eminence in the academic domain.
- To provide updated infrastructure.
- To educate value based education.
- To impart skills through efficient training programs.
- To cultivate culture and tradition with discipline and determination.

## REGULATIONS

### 1. Eligibility for Admission:

**Candidates who have passed in any one of the following or equivalent are eligible to apply:**

1. Bachelor's degree (under 10+2+3/4) in any subject with Mathematics at +2 level.
2. Bachelor's degree (under 10+2+3/4 or 10+3 year Diploma + 3 year later entry BE) in any subject with Mathematics / Business Mathematics / Statistics as one of the subject

### 2. Duration:

The programme shall be of two years duration spread over four semesters under choice based credit system.

The Maximum duration to complete the course shall be three academic years after normal completion of the programme.

The medium of instruction/study is English.

### 3. Eligibility for award of degree:

Candidates who obtain 75% and above in the aggregate shall be deemed to have passed the examination in **First Class with Distinction** provided they pass all the examinations prescribed for the programme at the first appearance.

Candidates, other than the above, who secure not less than 60% of the aggregate marks in the whole examinations, shall be declared to have passed the examination in **First Class**.

The remaining successful candidates shall be declared to have passed in **Second Class**.

Candidates who pass all the examinations prescribed for the programme in first instance and within a period of two academic years from the year of admission are only eligible for

**University Ranking.**

### 4. Course of Study:

The programme shall be of two years duration spread over four semesters under choice based credit system.

The Maximum duration to complete the course shall be three academic years after normal completion of the programme.

The medium of instruction/study is English.

### 5. Scheme of Examination:

Evaluation will be done on a continuous basis and will be evaluated four times during the course work.



Evaluation Will be objective type questions, short answers, essay so recombination of these, but the end semester examination is a prescribed question paper pattern.

### **6. Passing Rules:**

The Passing minimum shall be 50% out of 75 marks (38 marks)

(Record Note must be compulsorily submitted while attending the Practical Examination and No passing minimum)

The candidate shall be declared to have passed in the Theory / Practical / Project Work examination, if the candidate secures not less than 50% marks in EA and also in total of the prescribed marks. However submission of a record note book is a must.

The candidate shall be declared to have passed in the theory/practical/Dissertation examination if the candidate secures:

- (i) 50% marks in the ESE and
- (ii) 50% in ESE and IA put together

#### **i) Theory**

Evaluation of Internal Assessment: (25 Marks)

Evaluation of End Semester Examinations: 75 Marks

#### **ii) Practical**

#### **PRACTICAL/MINI PROJECT EXAMINATION**

Evaluation of Internal Assessment: 40

External Assessment :60

#### **iii) Project Work**

Continuous Internal Assessment : 50 Marks

External Assessment : Evaluation & Viva-Voce (Jointly) : 150 Marks



<b>Programme Outcomes (POs)</b>	
On successful completion of the MCA	
<b>PO1</b>	<b>Problem Solving Skill:</b> Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.
<b>PO2</b>	<b>Decision Making Skill:</b> Foster analytical and critical thinking abilities for data-based decision-making.
<b>PO3</b>	<b>Ethical Value:</b> Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.
<b>PO4</b>	<b>Communication Skill:</b> Ability to develop communication, managerial and interpersonal skills.
<b>PO5</b>	<b>Individual and Team Leadership Skill:</b> Capability to lead themselves and the team to achieve organizational goals.
<b>PO6</b>	<b>Employability Skill: Inculcate</b> contemporary business practices to enhance employability skills in the competitive environment.
<b>PO7</b>	<b>Entrepreneurial Skill: Equip</b> with skills and competencies to become an entrepreneur.
<b>PO8</b>	<b>Contribution to Society:</b> Succeed in career endeavors and contribute significantly to society.
<b>PO9</b>	<b>Multicultural competence:</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
<b>PO10</b>	<b>Moral and ethical awareness/reasoning: Ability</b> to embrace moral/ethical values in conducting one's life.

<b>Program Specific Outcomes (PSOs)</b>	
After the successful completion of MCA programme the students are expected to	
<b>PSO1</b>	<b>Placement:</b> To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions.
<b>PSO2</b>	<b>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.
<b>PSO3</b>	<b>Research and Development:</b> Design and implement HR systems and practices grounded in researches that comply with employment laws, leading the organization towards growth and development.

<b>PSO4</b>	<b>Contribution to Business World:</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
<b>PSO5</b>	<b>Contribution to the Society:</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit.
<b>PSO6</b>	Design, develop and test the software systems for real-time socio- economic problems and recommend appropriate IT Solutions.

<b>Programme Educational Objectives (PEOs)</b>	
The MCA programme describes accomplishments that graduates are expected to attain within five to seven years after graduation.	
<b>PEO1</b>	Sound background in fundamental core concepts and Computational principles, which are applied for complex problems Solving
<b>PEO2</b>	Developing the professional skills and entrepreneur skills with Team Work, leadership and communication qualities.
<b>PEO3</b>	Practicing lifelong learning for successful professional career with Ethical values.
<b>PEO4</b>	To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
<b>PEO5</b>	To solve problems by using / applying a concept learned in problem solving skills

**CREDIT DISTRIBUTION FOR 2 YEARS MCA PROGRAMME**

<b>Part</b>	<b>Course Type</b>	<b>Credits per Course</b>	<b>No. of Papers</b>	<b>Total Credits</b>
<b>Core</b>	Core Courses- Theory	5	7	35
	Core Courses- Theory	3	1	3
	Core Courses- Practical	5	2	10
	Core Courses- Practical	4	1	4
	Core Courses- Practical	3	2	6
	Project with VIVA VOCE	10	1	10
<b>Elective</b>	Elective Courses- Theory	2	5	10
	Elective Courses- Practical	2	3	6
	Elective Courses- Practical	1	2	2
	Mini Project	-	-	-
	Skill Enhancement Course -SEC (NME,NME Lab, Professional Competency)	2	3	06
<b>Internship</b>	Internship	2	1	02
<b>Non Major Elective</b>	Online Courses SWAYAM	-	-	-
	Supportive Courses	-	-	-
<b>Extension Activity</b>	Extension Activity	1	-	01
<b>Total Credits</b>				<b>95</b>

**CONSOLIDATED SEMESTER WISE AND COMPONENT WISE CREDIT DISTRIBUTION  
FOR 2 YEARS MCA PROGRAMME**

Parts	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Total Credits
Core	14	14	22	20	-	-	70
Elective	06	9	03	04	-	-	22
Internship / Industrial Activity	-	-	02	-	-	-	02
Non Major Elective	-	-	-	-	-	-	-
Extension Activity Part V	-	-	-	01	-	-	01
<b>Total</b>	<b>20</b>	<b>23</b>	<b>27</b>	<b>25</b>	<b>-</b>	<b>-</b>	<b>95</b>

**METHOD OF EVALUATION**

Evaluation	Components	Marks
Internal Evaluation	Continuous Internal Assessment Test	15
	Assignments	3
	Class Participation	2
	Distribution of marks for Attendance (in percentage) 96 – 100: 5 Marks 91 – 95: 4 Marks 86 – 90: 3 Marks 81 – 85: 2 Marks	5
External Evaluation	End Semester Examination	75 Marks
<b>Total</b>		<b>100 Marks</b>

**Note:** 1.PG Programmes- A candidate must score minimum 13 marks in Internal and 38 marks in External Evaluation.



### CONTINUOUS INTERNAL ASSESSMENT

Categorizing Outcome Assessment Levels Using Bloom's Taxonomy

level	Cognitive Domain	Description
K1	Remember	It is the ability to remember the previously learned concepts or ideas.
K2	Understand	The learner explains concepts or ideas.
K3	Apply	The learner uses existing knowledge in new contexts.
K4	Analyze	The learner is expected to draw relations among ideas and to compare and contrast.
K5	Evaluate	The learner makes judgments based on sound analysis.
K6	Create	The learner creates something unique or original.

### Question Paper Blue Print for Continuous Internal Assessment – I & II

Duration: 2 Hours		Maximum: 50 marks					
Section	K level						Marks
	K1	K2	K3	K4	K5	K6	
A (no choice)	10						10 X 1 =10
B (no choice)		1	1				2 X 5 =10
C (either or choice)				3			3 x 10 = 30
Total							50 marks

*Note: K4 and K5 levels will be assessed in the Model Examination whereas K5 and K6 Levels will be assessed in the End Semester Examinations.*

**Question Paper Blue Print for Continuous Internal Assessment - I**

Time: 2 Hours

Total Marks: 50 Marks

Minimum Pass: 20 Marks

Unit	Section - A	Section - B	Section - C
I	Q.N. 1, 2, 3, 4, 5	Q.N. 11	Q.N. 13 A, 13 B
I or II	-	-	Q.N. 14 A, 14 B
II	Q.N. 6, 7, 8, 9, 10	Q.N. 12	Q.N. 15 A, 15 B

**SECTION – A (10 X 1 = 10 Marks)**

ANSWER ALL THE QUESTIONS

**SECTION – B (2 X 5 = 10 Marks)**

ANSWER ALL THE QUESTIONS

**SECTION – C (3 X 10 = 30 Marks)**

ANSWER ALL THE QUESTIONS (Either or Choice)

**Question Paper Blue Print for Continuous Internal Assessment - II**

Time: 2 Hours

Total Marks: 50 Marks

Minimum Pass: 20 Marks

Unit	Section - A	Section - B	Section - C
III	Q.N. 1, 2, 3, 4, 5	Q.N. 11	Q.N. 13 A, 13 B
III or IV	-	-	Q.N. 14 A, 14 B
IV	Q.N. 6, 7, 8, 9, 10	Q.N. 12	Q.N. 15 A, 15 B

**SECTION – A (10 X 1 = 10 Marks)**

ANSWER ALL THE QUESTIONS

**SECTION – B (2 X 5 = 10 Marks)**

ANSWER ALL THE QUESTIONS

**SECTION – C (3 X 10 = 30 Marks)**

ANSWER ALL THE QUESTIONS (Either or Choice)

### Question Paper Blue Print for Model Examination & End Semester Examination

Duration: 3 Hours		Maximum: 75 marks						
Section		K level						Marks
		K1	K2	K3	K4	K5	K6	
A (no choice, three questions from each unit)		15						15 X 1 =15
B (choice, one question from each unit)			1	1				2 X 5 =10
C (either or choice & two questions from each unit)	<i>Courses with K4 as the highest cognitive level</i>				4	1		5 x 10 = 50
	<i>Course with K5 as the highest cognitive level wherein three K4 questions and two K5 questions are compulsory.</i>				3	2		
	<i>Course with K6 as the highest cognitive level wherein two questions each on K4, K5 and one question on K6 are compulsory.</i>				2	2	1	
Total								75 marks

**Question Paper Blue Print for Model Examination & End Semester Examination**

Time: 2 Hours

Total Marks: 75 Marks

Minimum Pass: 30 Marks

Unit	Section - A	Section - B	Section – C
I	Q.N. 1, 2, 3	Q.N. 16	Q.N. 21 A, 21 B
II	Q.N. 4, 5, 6	Q.N. 17	Q.N. 22 A, 22 B
III	Q.N. 7, 8, 9	Q.N. 18	Q.N. 23 A, 23 B
IV	Q.N. 10, 11, 12	Q.N. 19	Q.N. 24 A, 24 B
V	Q.N. 13, 14, 15	Q.N. 20	Q.N. 25 A, 25 B

**SECTION – A (15 X 1 = 15 Marks)**

ANSWER ALL THE QUESTIONS

**SECTION – B (2 X 5 = 10 Marks)**

ANSWER ANY TWO QUESTIONS

**SECTION – C (5 X 10 = 50 Marks)**

ANSWER ALL THE QUESTIONS (Either or Choice)

**Question Paper Blue Print for Model Practical Examination & End Semester Examination**  
**(Practical)**

Time: 3 Hours

Total Marks: 100 Marks

Minimum Pass: 50 Marks

<b>Practical Marks</b>	<b>Maximum Mark</b>	<b>Minimum Mark</b>
Internal	40	16
External	60	24
Total	100	40

**Evaluation for End Semester Examinations (Practical)**

**Each question: 30 Marks**

Record	10 marks
Problem Understanding	05 marks
Program writing	20 marks
Viva-voce	05 marks
Debugging and Modification	15 marks
For Correct Results	05 marks
<b>TOTAL</b>	<b>60 MARKS</b>

\*Submission of record with due certification is a must for external practical examinations.

\*\*A student should complete all requires experiments to get 10 marks for the record.

## Scheme of Examination for MCA

### First Year – Semester - I

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23PCA01	Core - I Discrete Mathematics	5	5	25	75	100
	23PCA02	Core - II Linux and shell programming	5	5	25	75	100
	23PCA03	Core - III Python Programming	5	4	25	75	100
	23PCAE02	Elective – I Architecture and Frameworks	3	2	25	75	100
	23PCAEP02	Elective Lab - I Architecture and Frameworks lab	2	1	40	60	100
	23PCAE03	Elective – II Software Development Technologies	3	2	25	75	100
	23PCAEP03	Elective Lab – II Software Development Technologies Lab	2	1	40	60	100
<b>Total</b>			<b>25</b>	<b>20</b>			

### First Year – Semester - II

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23PCA04	Core – IV Data Structures and Algorithms	5	5	25	75	100
	23PCA05	Core – V Big Data Analytics	5	5	25	75	100
	23PCAP01	Core Lab - I Data Structures and Algorithms Lab	4	4	40	60	100
	23PCAE06	Elective - III Computer Vision	2	2	25	75	100
	23PCAEP06	Elective Lab – III Computer Vision Lab	2	2	40	60	100
	23PCAE07	Elective - IV Cyber Security	3	2	25	75	100
	23PCAEP07	Elective Lab – IV Cyber Security Lab	2	2	40	60	100
II	23PSOCCC01	Fundamentals of Human Rights	2	1	25	75	100
<b>Total</b>			<b>25</b>	<b>23</b>			

### Second Year – Semester - III

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23PCA06	Core - VI Advanced Java Programming	5	5	25	75	100
	23PCA07	Core - VII Web Technology	5	5	25	75	100
	23PCA08	Core - VIII Advanced Machine Learning	5	5	25	75	100
	23PCAP02	Core Lab - II Advanced Java Programming Lab	3	3	40	60	100
	23PCAP03	Core Lab - III Web Technologies Lab	3	3	40	60	100
	23PCANMEP01	NME Lab - I Integrated technology(AML) Lab	2	2	40	60	100
	23PCAI01	Core - IX Internship and Industrial Activity	-	2	-	-	100
	23PCASECP01	Skill Enhancement Professional Competency Skill - Data Visualizations Lab	2	2	25	75	100
<b>Total</b>			<b>25</b>	<b>27</b>			

### Second Year – Semester - IV

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23PCAP04	Core Lab – IV Industry Dynamics Technology-Data Visualizations Lab	5	5	25	75	100
	23PCAP05	Core Lab - V Big Data Analytics Lab	5	5	40	60	100
	23PCAPR1	Core - Project work and Viva-voce	10	10	50	150	200
	23PCAE10	Elective – V High Performance Computing	3	2	25	75	100
	23PCAEP10	Elective Lab - V High Performance Computing Lab	2	2	40	60	100
II	23PCAX01	Extension Activity	-	1	-	-	
<b>Total</b>			<b>25</b>	<b>25</b>			

\*\*Ins. Hrs – Instructional Hours, CIA- Continuous Internal Assessment, ESE- End Semester Examination

<b>Semester: I</b>	<b>Course Code: 23PCA01</b>	<b>Hours/Week: 7</b>	<b>Credit: 5</b>
<b>COURSE TITLE: CORE - I DISCRETE MATHEMATICS</b>			

**Course Overview:**

1. Discrete mathematics is the study of mathematical structures that are countable or otherwise distinct and separable.
2. Discrete structures can be finite or infinite.
3. Sequences and Summations. Learn about sequences and summations.
4. Binary and Bases. Learn about binary and other bases.
5. Permutations and Combination

**Learning Objectives:**

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

<b>Unit - I</b>	<b>Relations &amp; Functions</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>Mathematical Logic, Well-formed formulas, Normal forms of well-formed formulas, Rules of Inference for propositional calculus</b>	<b>10 Hours</b>
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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.



<b>Unit - III</b>	<b>Recurrence Relations, Permutations, Combinations</b>	<b>10 Hours</b>
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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.

<b>Unit - IV</b>	<b>Matrices</b>	<b>10 Hours</b>
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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.

<b>Unit - V</b>	<b>Graphs</b>	<b>10 Hours</b>
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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(s):**

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

**Reference Books:**

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

**Web Resources:**

1. <https://www2.cs.uh.edu/~arjun/courses/ds/DiscMaths4CompSc.pdf>
2. <https://www.kth.se/social/files/557ec6b0f27654784e263d66/fullbook.pdf>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

<b>Learning Outcomes:</b>		
Upon successful completion of this course, the student will be able to:		
<b>COs</b>	<b>Statements</b>	<b>Bloom's Level</b>
CO1	To understand the concepts of relations and functions distinguish among normal forms	K2
CO2	To analyze and evaluate the recurrence relations	K4-K5
CO3	To distinguish among various normal forms and predicate calculus	K5
CO4	To solve and know various types of matrices	K1
CO5	To evaluate and solve various types of graphs	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

<b>Mapping (COs vs POs)</b>										
	<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>CO1</b>	S	S	M	M	M	S	S	S	S	M
<b>CO2</b>	S	S	S	S	S	S	S	S	S	S
<b>CO3</b>	S	M	S	M	M	S	M	S	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	S	S
<b>CO5</b>	S	S	S	S	S	S	S	S	S	M

**S - Strong, M – Medium, L - Low**

<b>Semester: I</b>	<b>Course Code: 23PCA02</b>	<b>Hours/Week: 5</b>	<b>Credit: 5</b>
<b>COURSE TITLE: CORE - II LINUX AND SHELL PROGRAMMING</b>			

**Course Overview:**

1. This course explains the fundamental ideas behind the open source operating system approach to
2. Programming. Knowledge of Linux helps to understand OS level programming. Like the successful
3. Computer languages that came before, Linux is the blend of the best elements of its rich heritage combined with the innovative concepts required by its unique environment. This course involves
4. Kernel concepts, basics commands, shell scripting, file processing ,Socket programming Processes,
5. Inter process communication. This course is presented to students by power point projections, course handouts, lecture notes, assignments, objective and subjective tests

**Learning Objective:**

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

<b>Unit - I</b>	<b>Basic bash Shell Commands, Basic Script Building, Using Structured Commands</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>More Structured Commands, Handling User Input, Script Control</b>	<b>10 Hours</b>
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**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.

<b>Unit - III</b>	<b>Creating Functions, Writing Scripts for Graphical Desktops, Introducing sed and gawk</b>	<b>10 Hours</b>
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**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.

<b>Unit - IV</b>	<b>Regular Expressions, Advanced sed, Advanced gawk</b>	<b>10 Hours</b>
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**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.

<b>Unit - V</b>	<b>\Working with Alternative Shells, Writing Simple Script Utilities, Producing Scripts for Database, Web, and E-Mail, Using Python as a Bash Scripting Alternative</b>	<b>10 Hours</b>
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**Working with Alternative Shells:** Understanding the dash shell Programming in the dash shell - Introducing the ash shell - Writing scripts for ash. **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 - Python arguments - Supplying arguments, Counting arguments - Significant whitespace - Reading user input - Using Python to write to files - String manipulation.

**Text Book(s):**

1. Richard Blum, Christine Brenham, —Linux Command Line and Shell Scripting BIBLE, Wiley Publishing, 3rd Edition, 2015.Chapters: 3, 11 to 14, 16 to 25.
2. MokhtarEbrahim, Andrew Mallet, —Mastering Linux Shell Scripting, Packet Publishing, 2nd Edition, 2018. Chapter: 14.

**Reference Books:**

1. CliffFlynt, Sarath Lakshman, Shantanu Tushar, —Linux Shell Scripting Cookbook , Packet Publishing, 3rd Edition, 2017.
2. Stephen G. Kochan, Patrick Wood, —Shell Programming in Unix, Linux, and OS X, Addison Wesley Professional, 4th 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 Abeles, — UNIX for Programmers and Users, 3rd Edition, Pearson Education, 2003.

**Web Resources:**

1. <https://www.freecodecamp.org/news/bash-scripting-tutorial-linux-shell-script-and-command-line-for-beginners/>
2. <https://data-flair.training/blogs/shell-programming-in-linux/>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
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 (COs vs POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	-	S	L	-	M	M	M
CO2	S	S	M	-	S	L	-	M	M	S
CO3	S	S	M	-	S	L	-	M	M	M
CO4	S	S	M	-	S	L	-	M	M	M
CO5	S	S	S	-	S	L	-	M	M	M

S - Strong, M – Medium, L – Low

Semester: I	Course Code: 23PCA03	Hours/Week: 5	Credit: 4
<b>COURSE TITLE: CORE - III PYTHON PROGRAMMING</b>			

#### Course Overview:

1. Python is a dynamic, interpreted (byte code-compiled) language. There are no type declarations of variables, parameters, functions, or methods in source code. This makes the code short and flexible, and you lose the compile-time type checking of the source code.

#### Learning Objectives:

1. To acquire programming skills in core Python
2. To learn Strings and function
3. To develop object oriented skills in Python
4. To comprehend various Python Packages
5. To develop web applications using Django

Unit - I	Introduction, Loops and Selection Statements	10 Hours
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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.

<b>Unit - II</b>	<b>Strings and Text Files, Lists and Dictionaries, Design with Functions</b>	<b>10 Hours</b>
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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.

<b>Unit - III</b>	<b>Design with Classes</b>	<b>10 Hours</b>
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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 – Graphical User 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

<b>Unit - IV</b>	<b>Working with Python Packages</b>	<b>10 Hours</b>
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Working with Python Packages: Numbly Library - ND array – Basic Operations, Indexing, Slicing and Iteration – Array manipulation - Pandas – The Series - The Data Frame, The Index Objects – Data Visualization with Matplotlib – The Matplotlib Architecture – pyplot, The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts.

<b>Unit - V</b>	<b>Django</b>	<b>10 Hours</b>
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Installing Django – Building an Application – Project Creation - Designing the Data Schema, Creating an administration site for models - Working with Query Sets and Managers -, Retrieving Objects – Building List and Detail Views.

#### **Text Book(s):**

1. Allen B. Downey, Think Python Second Edition, 2021.

#### **Reference Books:**

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).

**Web Resources:**

1. <https://www.programiz.com/python-programming>
2. [https://bugs.python.org/file47781/Tutorial\\_EDIT.pdf](https://bugs.python.org/file47781/Tutorial_EDIT.pdf)

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

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

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

**Mapping (COs vs POs)**

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

S- Strong; M-Medium; L-Low



<b>Semester: I</b>	<b>Course Code: 23PCAE02</b>	<b>Hours/Week: 3</b>	<b>Credit: 2</b>
<b>COURSE TITLE: ELECTIVE – I ARCHITECTURE AND FRAMEWORKS</b>			

**Course Overview:**

1. The Architecture and Framework are designed to equip professionals with the skills needed to design, implement, and manage architectures. Aligning architectural practices with industry standards improves interoperability, and compliance within the organization.

**Learning Objectives:**

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

<b>Unit - I</b>	<b>Importance of Software architecture</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>Domain Knowledge, Software Quality attributes</b>	<b>10 Hours</b>
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Domain Knowledge – Developing business acumen – Domain - driven design – requirement engineering – requirement elicitation - Software Quality attributes: Maintainability – Usability – Availability - Portability – Interoperability – Testability.

<b>Unit - III</b>	<b>Software Architectures design</b>	<b>10 Hours</b>
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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.

<b>Unit - IV</b>	<b>Designing orthogonal software systems</b>	<b>10 Hours</b>
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Designing orthogonal software systems – Minimizing complexity – SOLID design principles  
Software architecture patterns – layered – Event - driven architecture – Model - View patterns –  
Service - oriented architecture.

<b>Unit - V</b>	<b>Architecting Modern Applications</b>	<b>10 Hours</b>
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Architecting Modern Applications. - Importance of Performance – Performance improvement -  
Server side caching – Web application performance – Database performance, Securing software  
systems – Threat modeling – Secure by design.

**Text Book(s):**

1. Joseph Ingeno, —Software Architect’s Handbook|| Packet Publishing 2018.

**Reference Books:**

1. Oliver Vogel, Indo Arnold, Arif Chughtai and Timo Kehrer, — 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

**Web Resources:**

1. <https://www.cio.com/article/222421/what-is-enterprise-architecture-a-framework-for-transformation.html>
2. <https://www.altexsoft.com/blog/enterprise-architecture-frameworks-documenting-your-roadmap-to-change/>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
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, K6 – Create

Mapping (COs vs POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	-	L	M	S	M	M	L	S
CO2	M	S	-	M	M	L	S	S	M	M
CO3	S	M	-	S	S	M	S	M	M	S
CO4	S	M	L	S	M	L	S	L	S	M
CO5	M	S	M	L	S	L	M	S	L	S

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

<b>Semester: I</b>	<b>Course Code: 23PCAE03</b>	<b>Hours/Week: 3</b>	<b>Credit: 2</b>
<b>COURSE TITLE: ELECTIVE – II SOFTWARE DEVELOPMENT TECHNOLOGIES</b>			

**Course Overview:**

1. Software development technologies are the tools and methods that developers use to design, develop, test, and deploy software applications. These include a wide range of software technologies, such as programming languages, frameworks and libraries, databases, and cloud computing platforms.

**Learning Objectives:**

1. To learn and Implementing Micro services.
2. To analyzing the Azure Kubernetes Service.
3. To learn and analyze .NET DevOps for Azure and its applications.
4. To building code for .NET core applications.
5. To get familiarized with Azure pipelines.

<b>Unit - I</b>	<b>Implementing Micro services, Azure Service Fabric, Monitoring Azure Service Fabric Clusters</b>	<b>10 Hours</b>
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Implementing Micro services: Client to micro services communication, Interservice communication, Data considerations, security, monitoring, micro services 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.

<b>Unit - II</b>	<b>Azure Kubernetes Service, Monitoring, Securing Micro services, Database Design for Micro services, Building Micro services on Azure Stack</b>	<b>10 Hours</b>
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Azure Kubernetes Service (AKS): Introduction to cabernets and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, Monitoring AKS clusters, native cabernets dashboard, Prometheus and Grafana. Securing, **Micro**

**services:** Authentication in micro services, Implanting security using API gateway pattern, Creating application using Ocrplot and securing APIs with Azure AD. Database Design for, Micro **services:** Data stores, monolithic approach, Micro services approach, harnessing cloud, computing, Database options on MS Azure, overcoming application development challenges. Building Micro services on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises, simplified, SaaS on Azure stack.

<b>Unit - III</b>	<b>NET Dev Ops for Azure, Professional Grade Dev Ops Environment, Tracking work, Tracking code,</b>	<b>10 Hours</b>
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NET Dev Ops for Azure: Dev Ops introduction, Problem and solution. Professional Grade Dev Ops Environment: The state of Dev Ops, professional grade Dev Ops, vision, Dev Ops architecture, tools for professional Dev Ops environment, Dev Ops centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Get repository, structure, branching pattern, Azure repos configuration, Get and Azure.

<b>Unit - IV</b>	<b>Building the code, Validating the code, Release candidate creation, Deploying the release, Operating and monitoring release</b>	<b>10 Hours</b>
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**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.

<b>Unit - V</b>	<b>Introduction to APIs, API Strategy and Architecture, API Development, API Gateways, API Security</b>	<b>10 Hours</b>
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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(s):**

1. Harsh Chawla and Hemans Katharina, Building Micro services 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, Addison Wesley-Pearson Publication, First Ediiton 2015.
3. John Ferguson Smart, Jenkins, the Definitive Guide, O'Reilly Publication, First Ediiton 2011.

**Web Resources:**

1. <https://www.intelivita.com/blog/software-development-technologies/>
2. <https://www.ibm.com/topics/software-development>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
CO1	To understand, apply and summarize the basic concepts of Micro services communication Microsoft Azure and DevOps 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, analyses 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 (COs vs POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	M	-	M	-	-	-	S	-
<b>CO2</b>	S	S	M	-	M	-	-	-	S	-
<b>CO3</b>	S	S	S	-	S	-	-	-	S	S
<b>CO4</b>	S	S	M	-	M	-	-	-	S	-
<b>CO5</b>	S	S	M	-	M	-	-	-	S	-

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

<b>Semester: I</b>	<b>Course Code: 23PCAEP02</b>	<b>Hours/Week: 2</b>	<b>Credit: 1</b>
<b>COURSE TITLE: ELECTIVE LAB - I ARCHITECTURE AND FRAMEWORKS LAB</b>			

#### Course Overview:

1. The Architecture and Framework are designed to equip professionals with the skills needed to design, implement, and manage architectures. Aligning architectural practices with industry standards improves interoperability, and compliance within the organization.

#### Learning Objective:

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

<b>EXERCISE No</b>	<b>LAB EXERCISES</b>	<b>Required Hours (20 Hours)</b>
1	Find the Web ID profile document and display the necessary attributes	2 Hours
2	Set and access the primary authentications with account recovery mechanisms	2 Hours
3	Set and access the secondary authentications with account recovery mechanisms	2 Hours
4	Design authorization and web access control	2 Hours
5	Find the content representation	2 Hours
6	Reading resources from HTTP REST API and Web Sockets API	2 Hours
7	Writing resources from HTTP REST API and Web Sockets API	2 Hours
8	Data notification using Social Web App protocol	2 Hours
9	Managing subscriptions and friends list using Social Web App protocol	2 Hours
10	Managing list of followers and following list using Social Web App protocol	2 Hours

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning



**Learning Outcomes:**

Upon successful completion of this course, the students will be able:

COs	Statements	Bloom's Level
CO1	Comprehend the programming skills of Software architecture tools and packages	K1-K6
CO2	Understand and implement the user profiles and authentication with recovery mechanism.	K1-K6
CO3	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 (COs vs POs)**

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

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

<b>Semester: I</b>	<b>Course Code: 23PCAEP03</b>	<b>Hours/Week: 2</b>	<b>Credit: 1</b>
<b>COURSE TITLE: ELECTIVE LAB – II SOFTWARE DEVELOPMENT TECHNOLOGIES LAB</b>			

**Course Overview:**

1. Software development technologies are the tools and methods that developers use to design, develop, test, and deploy software applications. These include a wide range of software technologies, such as programming languages, frameworks and libraries, databases, and cloud computing platforms.

**Learning Objective:**

1. To understand the concept of DevOps with associated technologies and methodologies.
2. To be familiarized with Jenkins, which is used to build & test software Applications.
3. To understand Continuous integration in Devops environment.
4. To understand Docker to build, ship and run containerized images
5. To use Docker to deploy and manage Software applications running on Container.

**List of Programs**

<b>EXERCISE No</b>	<b>LAB EXERCISES</b>	<b>Required Hours (20 Hours)</b>
1	Deploy Version Control System / Source Code Management, install git and create a GitHub account.	2
2	Perform various GIT operations on local and remote repositories using GIT Cheat Sheet.	2
3	Continuous Integration: install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.	2
4	Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.	2
5	Implement Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.	2

6	Setup and Run Selenium Tests in Jenkins Using Maven.	2
7	Implement Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.	2
8	Implement Dockerfile instructions; build an image for a sample web application using Dockerfile.	2
9	Install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.	2
10	Implement LAMP/MEAN Stack using Puppet Manifest.	2

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

Upon successful completion of this course, the students will be able:

COs	Statements	Bloom's Level
CO1	To Understand and analyses the importance of Jenkins to Build, Deploy and Test Software Applications	K1-K6
CO2	To synthesis and summarize the importance of Software Configuration Management in DevOps	K1-K6
CO3	To identify, analyze and illustrate the Containerization of OS images and deployment of applications over Docker	K1-K6
CO4	To design, analyze and develop the Pull based Software Configuration Management	K1-K6
CO5	To design, analyze and develop Puppet Manifest	K1-K6
K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create		

Mapping (COs vs POs)										
CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	-	M	-	-	-	S	S
CO2	S	S	M	-	M	-	-	-	S	S
CO3	S	S	M	-	M	-	-	-	S	S
CO4	S	S	M	-	M	-	-	-	S	S
CO5	S	S	M	-	M	-	-	-	S	S

S- Strong; M-Medium; L-Low

<b>Semester: II</b>	<b>Course Code: 23PCA04</b>	<b>Hours/Week: 5</b>	<b>Credit: 5</b>
<b>COURSE TITLE: CORE – IV DATA STRUCTURES AND ALGORITHMS</b>			

#### Course Overview:

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

#### Learning Objectives:

1. Understand various ADT concepts.
2. Apply with proper ADT models with problem understanding.
3. Apply and Analyze right models based on the problem domain.
4. Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems.
5. Evaluate modern data structures with Python language.

<b>Unit - I</b>	<b>Abstract Data Type, Arrays, Sets Maps</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>Algorithm Analysis, Recursion</b>	<b>10 Hours</b>
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**Algorithm Analysis:** Experimental Studies - Seven Functions - Asymptotic Analyses.  
**Recursion:** Illustrative Examples - Analyzing Recursive Algorithms - Linear Recursion, Binary Recursion - Multiple Recursion.

<b>Unit - III</b>	<b>Stacks, Lists, Queues, and Deques, Trees</b>	<b>10 Hours</b>
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**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.

<b>Unit - IV</b>	<b>Priority Queues, Maps, Hash Tables, and Skip Lists</b>	<b>10 Hours</b>
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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.

<b>Unit - V</b>	<b>Search Trees, Sorting and Selection, Graph Algorithms</b>	<b>10 Hours</b>
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**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(s):

1. Rance D. Necaie, —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. BasantAgarwal; 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.

**Web Resources:**

1. <https://github.com/cjbt/Free-Algorithm-Books/blob/master/book/Data%20Structures%20%26%20Algorithms%20in%20Python.pdf>
2. <https://github.com/cjbt/Free-Algorithm-Books/blob/master/book/Data%20Structures%20and%20Algorithms%20with%20Python.pdf>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
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	K1-K6
CO3	Apply with proper ADT models with problem understanding	K1-K6
CO4	Apply and Analyze right models based on the problem domain	K1-K6
CO5	Evaluate modern data structures with Python language	K1-K6
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

**Mapping (COs vs POs)**

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

S- Strong; M-Medium; L-Low

<b>Semester: II</b>	<b>Course Code: 23PCA05</b>	<b>Hours/Week: 5</b>	<b>Credit: 5</b>
<b>COURSE TITLE: CORE – V BIG DATA ANALYTICS</b>			

**Course Overview:**

1. To introduce big data tools & Information Standard formats.
2. To understand the basic concepts of big data.
3. To learn Hadoop, HDFS and Map Reduce concepts.
4. To teach the importance of NoSQL.
5. To explore the big data tools such as Hive, Base and Pig.

**Learning Objectives:**

1. To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools
2. To comprehend, implement and review the concepts of data science and big data analytics projects using Map Reduce, and Mongo DB.
3. To understand, use and analyze the concepts of big data analytics projects using HIVE database.
4. To collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.
5. To illustrate, develop and review the concepts of PIG database in Hadoop environment.

<b>Unit - I</b>	<b>Big Data and Analytics, Introduction to Big Data , Environment Big Data Analytics</b>	<b>10 Hours</b>
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**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.

<b>Unit - II</b>	<b>Technology Landscape</b>	<b>10 Hours</b>
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**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.

<b>Unit - III</b>	<b>Mongodb and Map reduce Programming</b>	<b>10 Hours</b>
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**MongoDB:** Mongo DB - Terms used in RDBMS and Mongo DB - Data Types, MongoDB Query Language. **Map Reduce:** Mapper – Reducer – Combiner – Partitioner, Searching – Sorting – Compression.

<b>Unit - IV</b>	<b>Hive</b>	<b>07 Hours</b>
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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.

<b>Unit - V</b>	<b>Pig</b>	<b>07 Hours</b>
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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(s):**

1. Seema Acharya, Submachine Chellappan, “Big Data and Analytics”, Wiley Publications, First Edition, 2015.

#### **Reference Books:**

1. Judith Huruwitz, Alan Nugent, Fern Helper, 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.

### Web Resources:

1. [https://aitskadapa.ac.in/ebooks/AI&DS/BIG%20DATA/Data%20Science%20\\_%20Big%20Data%20Analytics%20\(%20PDFDrive%20\).pdf](https://aitskadapa.ac.in/ebooks/AI&DS/BIG%20DATA/Data%20Science%20_%20Big%20Data%20Analytics%20(%20PDFDrive%20).pdf)
2. [https://mrcet.com/downloads/digital\\_notes/IT/\(R17A0528\)%20BIG%20DATA%20ANALYTICS.pdf](https://mrcet.com/downloads/digital_notes/IT/(R17A0528)%20BIG%20DATA%20ANALYTICS.pdf)

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

### Learning Outcomes:

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

COs	Statements	Bloom's Level
CO1	Understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K2
CO2	Collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.	K3
CO3	Comprehend, implement and review the concepts of data science and big data analytics projects using Map Reduce, and MongoDB.	K4
CO4	Understand, use and analyze the concepts of big data analytics projects using HIVE database.	K2
CO5	Illustrate, develop and review the concepts of PIG database in Hadoop environment.	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

### Mapping (COs vs POs)

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

S- Strong; M-Medium; L-Low

<b>Semester: II</b>	<b>Course Code: 23PCAE06</b>	<b>Hours/Week: 2</b>	<b>Credit: 2</b>
<b>COURSE TITLE: ELECTIVE - III COMPUTER VISION</b>			

**Course Overview:**

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

**Learning Objectives:**

1. To understand and recall computer vision and its application areas
2. To apply and analyze a design range of algorithms for image processing and computer vision
3. To develop build a computer vision system
4. To develop incorporate machine learning techniques with computer vision system
5. To apply and analyze image segmentation and image registration

<b>Unit - I</b>	<b>Basic image handling and processing, Local Image Descriptors</b>	<b>10 Hours</b>
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**Basic Image Handling and Processing:** PIL – the Python Imaging Library – Matplotlib – Numbly - SciPy - Advanced example: Image de-noising. **Local Image Descriptors:** Harris corner detector, SIFT – Scale - Invariant Feature Transform - Matching Geotagged Images.

<b>Unit - II</b>	<b>Image to Image Mappings, Camera Models and Augmented Reality</b>	<b>10 Hours</b>
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**Image to Image Mappings:** Homographs' - Warping images - Creating Panoramas. **Camera Models and Augmented Reality:** The Pin - hole Camera Model - Camera Calibration, Pose Estimation from Planes and Markers - Augmented Reality.

<b>Unit - III</b>	<b>Multiple View Geometry, Clustering Images</b>	<b>10 Hours</b>
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**Multiple View Geometry:** Epipolar Geometry - Computing with Cameras and 3D Structure, Multiple Views Reconstruction-Stereo Images. **Clustering Images:** K-means Clustering, Hierarchical Clustering - Spectral Clustering.

<b>Unit - IV</b>	<b>Searching Images, Classifying Image Content</b>	<b>07 Hours</b>
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**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.

<b>Unit - V</b>	<b>Image Segmentation, Open CV</b>	<b>07 Hours</b>
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**Image Segmentation:** Graph Cuts - Segmentation using Clustering - Variation Methods. **Open CV:** Python Interface - Open CV Basics - Processing Video - Tracking.

**Text Book(s):**

1. Programming Computer Vision with Python – Jan Erik Solemn

**Reference Books:**

2. Mastering Open CV 4 with Python: A practical guide – Alberto Fernandez Villain.

**Web Resources:**

1. [http://programmingcomputervision.com/downloads/ProgrammingComputerVision\\_CCdraft.pdf](http://programmingcomputervision.com/downloads/ProgrammingComputerVision_CCdraft.pdf)
2. [https://github.com/edward-wq/books/blob/master/ Programming%20](https://github.com/edward-wq/books/blob/master/Programming%20Computer%20Vision%20with%20Python.pdf)

[Computer %20Vision%20with%20Python.pdf](https://github.com/edward-wq/books/blob/master/Programming%20Computer%20Vision%20with%20Python.pdf)

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

<b>Learning Outcomes:</b> Upon successful completion of this course, the student will be able to:		
<b>COs</b>	<b>Statements</b>	<b>Bloom's Level</b>
CO1	To understand and recall computer vision and its application areas	K1-K6
CO2	To develop build a computer vision system	K1-K6
CO3	To apply and analyze a design range of algorithms for image processing and computer vision	K1-K6
CO4	To develop incorporate machine learning techniques with computer vision system	K1-K6
CO5	To apply and analyze image segmentation and image registration	K1-K6
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

<b>Mapping (COs vs POs)</b>										
	<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>CO1</b>	S	L	M	L	L	L	M	M	M	S
<b>CO2</b>	S	M	L	M	M	L	S	L	S	L
<b>CO3</b>	S	S	S	M	M	L	M	L	M	L
<b>CO4</b>	S	S	S	M	M	L	M	L	M	L
<b>CO5</b>	S	S	S	M	M	L	S	L	S	L

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

<b>Semester: II</b>	<b>Course Code: 23PCAE07</b>	<b>Hours/Week: 3</b>	<b>Credit: 2</b>
<b>COURSE TITLE: ELECTIVE - IV CYBER SECURITY</b>			

**Course Overview:**

1. To understand the basics of Cybercrime and Computer forensics with protecting mechanism.
2. To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines.
3. 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.
4. To understand and learn the method of seize the digital evidence.
5. To learn and analyze the concepts of digital forensics with cybercrime prevention techniques.

**Learning Objectives:**

1. Understand, describe, analyze and examine the basics of Cyber security concepts and its implementation in India.
2. Understand, apply and evaluate the various investigation roles and Wi Fi protecting mechanisms.
3. Understand, illustrate and evaluate the method of seize the digital information and evidences forensics data and evaluate the forensics reports.
4. Comprehend and demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem and Forensics.
5. Comprehend, apply and appraise the methods digital forensics with cybercrime prevention techniques

<b>Unit - I</b>	<b>Introduction to cybercrime</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>Tips for buying online</b>	<b>07 Hours</b>
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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 - smart phone security guidelines – purses, wallets, smart phones, platforms, setup and installation - communicating securely with a smartphone.

<b>Unit - III</b>	<b>Cyber investigation roles</b>	<b>10 Hours</b>
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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.

<b>Unit - IV</b>	<b>Seizure of digital information</b>	<b>10 Hours</b>
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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.

<b>Unit - V</b>	<b>Digital forensics and analyzing data</b>	<b>07 Hours</b>
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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 Book(s):**

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 Kipper, —Cyber Security Ein Einblick fur Wirtschaft swished schaftler Fachmedien 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.

**Web Resources:**

1. [http://www.cs.unibo.it/babaoglu/courses/security/resources/documents/Computer\\_Security\\_Principle\\_s\\_and\\_Practice\\_%283rd\\_Edition%29.pdf](http://www.cs.unibo.it/babaoglu/courses/security/resources/documents/Computer_Security_Principle_s_and_Practice_%283rd_Edition%29.pdf)
2. [https://www.uoitc.edu.iq/images/documents/informatics-institute/exam\\_materials/Introduction%20to%20Computer%20Security%20pdf%20DONE.pdf](https://www.uoitc.edu.iq/images/documents/informatics-institute/exam_materials/Introduction%20to%20Computer%20Security%20pdf%20DONE.pdf)

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
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 and Forensics.	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 (COs vs POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	-	L	M	L	M	M	-	M
CO2	M	S	-	L	M	L	M	M	-	M
CO3	M	S	L	L	M	L	M	M	-	M
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**

<b>Semester: II</b>	<b>Course Code: 23PSOCCC01</b>	<b>Hours/Week: 2</b>	<b>Credit: 2</b>
<b>COURSE TITLE: FUNDAMENTALS OF HUMAN RIGHTS</b>			

**Course Overview:**

1. To introduce big data tools & Information Standard formats.
2. To understand the basic concepts of big data.
3. To learn Hadoop, HDFS and Map Reduce concepts.
4. To teach the importance of NoSQL.
5. To explore the big data tools such as Hive, HBase and Pig.

**Learning Objectives:**

1. Understand the basic facets of human rights.
2. Know the historical background of the various human rights movement in India.
3. Grasp the rights of the marginalized and other disadvantaged people in India.
4. Comprehend the Constitutional provisions of human rights in India.
5. Understand the redressed mechanism of the human rights violations.

<b>Unit - I</b>	<b>Introduction to Human Rights</b>	<b>04 Hours</b>
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**Introduction:** Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights, Evolution of Human Rights – Formation, Structure and Functions of the UNO, Universal Declaration of Human Rights – International Covenants – Violations of Human Rights in the Contemporary Era.



<b>Unit - II</b>	<b>Human Rights in India</b>	<b>04 Hours</b>
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**Human Rights in India:** Development of Human Rights in India – Constituent Assembly and Indian Constitution - Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.

<b>Unit - III</b>	<b>Rights of Marginalized and other Disadvantaged People</b>	<b>04 Hours</b>
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**Rights of Marginalized and other Disadvantaged People:** Rights of Women – Rights of Children. Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes, Rights of Minorities – – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.

<b>Unit - IV</b>	<b>Human Rights Movements</b>	<b>04 Hours</b>
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**Human Rights Movements:** Peasant Movements (Tebhaga and Telangana), Scheduled Caste Movements (Maher and Ad-Dharma) – Scheduled Tribes Movements (Sandal and Munda), Environmental Movements (Chipko and Narmada BachaoAndolan) – Social Reform Movements (Viacom and Self Respect).

<b>Unit - V</b>	<b>Redressed Mechanisms</b>	<b>04 Hours</b>
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**Redressed Mechanisms:** Protection of Human Rights Act, 1993 (Amendment 2019), Structure and Functions of National and State Human Rights Commissions, National Commission for SCs – National Commission for STs – National Commission for Women, National Commission for Minorities – Characteristics and Objectives of Human Rights Education.

**Text Book(s):**

1. Dr. S. Maharaja Begum, Human Rights in India: Issues and perspectives, APH Publishing Corporation, New Delhi, 2010.
2. AshaKiran, the History of Human Rights, Mangalam Publications, Delhi, 2011.
3. BaniBorgohain, Human Rights, Kanishka Publishers & Distributors, New Delhi-2, 2007.
4. JayantChudhary, a Textbook of Human Rights, Wisdom Press, New Delhi, 2011.
5. AnjuSoni, Human Rights in India, Venus Publication, New Delhi, 2019.

**Reference Books:**

1. SudarshanamGankidi, Human Rights in India: Prospective and Retrospective, Rabat Publications, Jaipur, 2019.
2. SatvinderJuss, Human Rights in India, Routledge, New Delhi, 2020.
3. Namita Gupta, Social Justice and Human Rights in India, Rabat Publications, Jaipur, 2021.
4. Mark Freeze, the Sociology of Human Rights, John Willy & Sons, U.K. 2014.
5. Chiranjivi J. Nirmal, Human Rights in India: Historical, Social and Political Perspectives, Oxford University Press, New York, 2000.

**Web Resources:**

1. [www.cbom.atozmath.com](http://www.cbom.atozmath.com)
2. [http://www.pondiuni.edu.in/storage/dde/downloads/mbaii\\_qt.pdf](http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf)

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
CO1	Understand the basic facets of human rights.	PO4, PO6, PO1
CO2	Comprehend the Constitutional provisions of human rights in India.	PO1, PO2
CO3	Grasp the rights of the marginalized and other disadvantaged people in India.	PO4, PO5
CO4	Know the historical background of the various human rights movement in India.	PO6
CO5	Understand the redressed mechanism of the human rights violations.	PO3, PO8
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	3	3	3	3	2	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	2	3	3	3
<b>CO3</b>	3	2	3	3	3	3	3	3	3	3
<b>CO4</b>	2	3	3	3	3	3	3	2	3	3
<b>CO5</b>	3	3	3	3	2	3	2	3	3	3

**S-Strong (3) M-Medium (2) L-Low (1)**

<b>Semester: II</b>	<b>Course Code: 23PCAEP06</b>	<b>Hours/Week: 2</b>	<b>Credit: 2</b>
<b>COURSE TITLE: ELECTIVE LAB – III COMPUTER VISION LAB</b>			

**Course Overview:**

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

**Learning Objectives:**

1. To understand and recall computer vision and its application areas
2. To apply and analyze a design range of algorithms for image processing and computer vision
3. To develop build a computer vision system
4. To develop incorporate machine learning techniques with computer vision system
5. To apply and analyze image segmentation and image registration

### List of Programs

EXERCISE No	LAB EXERCISES	Required Hours (26 Hours)
1	Image Loading, Exploring, and displaying an Image.	1
2	Access and Manipulate of Image Pixels.	2
3	Image Transformations. i) Resizing ii) Rotation	4
4	Addition operation of Two Images.	2
5	Image filtering operations i) Mean Filtering ii) Gaussian Filtering	4
6	Image Binarization Using Simple Thresholding method.	2
7	Edge Detection operation using Sober and Scharr Gradients.	3
8	Find Gray scale and RGB Histograms of an Image.	4
9	Segment an Image using K-means Clustering algorithm.	2
10	Write a program to classify an Image using KNN Classification algorithm	2

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

<b>COs</b>	<b>Statements</b>	<b>Bloom's Level</b>
CO1	To develop and implement the image loading and exploring.	K1-K6
CO2	To Evaluate the image transforms.	K1-K6
CO3	To apply and analyze for image processing de noising algorithms	K1-K6
CO4	To design and develop the Image Segmentation using Edge.	K1-K6
CO5	To apply and analyze image clustering and classification algorithms.	K1-K6

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

**Mapping (COs vs POs)**

<b>CO/PSO</b>	<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>CO1</b>	S	L	M	L	L	L	M	M	M	S
<b>CO2</b>	S	M	L	M	M	L	S	L	S	L
<b>CO3</b>	S	S	S	M	M	L	M	L	M	L
<b>CO4</b>	S	S	S	M	M	L	M	L	M	L
<b>CO5</b>	S	S	S	M	M	L	S	L	S	L

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

<b>Semester: II</b>	<b>Course Code: 23PCAEP07</b>	<b>Hours/Week: 2</b>	<b>Credit: 2</b>
<b>COURSE TITLE: ELECTIVE LAB – IV CYBER SECURITY LAB</b>			

**Course Overview:**

1. To learn and implement to Change the wireless device mode as monitor mode.
2. To develop in multiple vulnerabilities web server.
3. To understand and implement the open ports in the network.
4. To acquire programming skills in Implement various wireless device modes.
5. To comprehend related to find the sub domains of webpage.

**Learning Objectives:**

1. Understand, describe, analyze and examine the basics of Cyber security concepts and its implementation in India.
2. Understand, apply and evaluate the various investigation roles and Wi Fi protecting mechanisms.
3. Understand, illustrate and evaluate the method of seize the digital information and evidences forensics data and evaluate the forensics reports.
4. Comprehend and demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem and Forensics.
5. Comprehend, apply and appraise the methods digital forensics with cybercrime prevention techniques

**List of Programs**

<b>EXERCISE No</b>	<b>LAB EXERCISES</b>	<b>Required Hours (20 Hours)</b>
1	Install virtual box (kali Linux)	2
2	Generate a secure password using keep pass.	2
3	Change the wireless device mode as monitor mode.	2
4	Find the known and open vulnerabilities of system using metaspolit	2
5	Identify the multiple vulnerabilities webserver using nekton tool	2
6	Identify the open ports in the network using map tools.	2

7	List all the network around us and display the information about the networks.	2
8	Sniff and capture the packet sent over HTTP requests.	2
9	Find the owners of internet resources using Who is Lookup tool.	2
10	Find the subdomains of webpage using knock tool.	2

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

### Learning Outcomes:

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

COs	Statements	Bloom's Level
CO1	Comprehend the programming skills in Change the wireless device mode as monitor mode.	K1-K6
CO2	Understand and implement multiple vulnerabilities web server.	K1-K6
CO3	Evaluate the use of different wireless device modes.	K1-K6
CO4	Design to Solve related to find the sub domains 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 (COs vs POs)

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

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

<b>Semester: II</b>	<b>Course Code: 23PCAP01</b>	<b>Hours/Week: 4</b>	<b>Credit: 4</b>
<b>COURSE TITLE: CORE LAB - I DATA STRUCTURES AND ALGORITHMS LAB</b>			

**Course Overview:**

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

**Learning Objectives:**

1. Understand various ADT concepts.
2. Apply with proper ADT models with problem understanding.
3. Apply and Analyze right models based on the problem domain.
4. Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems.
5. Evaluate modern data structures with Python language.

**List of Programs**

<b>EXERCISE No</b>	<b>LAB EXERCISES</b>	<b>Required Hours (20 Hours)</b>
1	Recursion concepts. i) Linear recursion ii) Binary recursion.	2
2	Stack ADT.	2
3	Queue ADT.	2
4	Doubly Linked List ADT.	2
5	Heaps using Priority Queues.	2
6	Merge sort.	2
7	Quick sort.	2
8	Binary Search Tree.	2
9	Minimum Spanning Tree.	2
10	Depth First Search Tree traversal.	2



**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
CO1	Strong understanding in various ADT concepts.	K1-K6
CO2	To become a familiar with implementation of ADT models.	K1-K6
CO3	Apply sort and tree search algorithms	K1-K6
CO4	Evaluate the different data structure models.	K1-K6
CO5	Learn how to develop ADT for the various real-time problems.	K1-K6
K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create		

Mapping (COs vs POs)										
CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	S	S	M	M
CO2	S	M	S	M	M	L	S	M	S	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	S	M	M	S	M	M	S	S
CO5	S	S	S	S	L	M	S	M	M	M

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

<b>Semester: II</b>	<b>Course Code: 23PCANE02</b>	<b>Hours/Week: 3</b>	<b>Credit: 3</b>
<b>COURSE TITLE: NON MAJOR ELECTIVE COURSE - FUNDAMENTALS OF COMPUTERS AND COMMUNICATION</b>			

**Course Overview:**

1. Know the basics of Computers
2. Learn the internal Components of Computers
3. Understand the OS and its types

**Learning Objectives:**

1. Study the basics of networks and Internet
2. Get a clear idea on DBMS and its concepts

<b>Unit - I</b>	<b>Introduction</b>	<b>12 Hours</b>
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What is computer – Components of Computers – Advantages and Disadvantages of using computers – Computer Software – Categories of Computers - Elements of information systems. The Components of the Systems Unit: Processor – Data representation – Memory – Mobile Computers and Devices.

<b>Unit - II</b>	<b>Input and Output Device</b>	<b>12 Hours</b>
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What is input – what are input devices – keyboard – pointing device – mouse – other pointing devices – Voice input – Digital Cameras – Video input – Scanners and Reading devices Terminals – Biometric input - Input devices for physically challenged users - Output: What is output – display devices – Monitors – Printers – Speakers, Headphones and Ear phones – output device for physically challenged users – Storage devices

<b>Unit - III</b>	<b>Operating Systems and Utility Programs</b>	<b>12 Hours</b>
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System software – Operating system – Operating system functions – types of operating systems – standalone operating systems – network operating systems – embedded operating system. Application Software: Application software – Business software – Graphics and Multimedia Software – Application software for Communication

<b>Unit - IV</b>	<b>Internet and World Wide Web</b>	<b>12 Hours</b>
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Internet – History of the Internet – How the Internet works –WWW – E-commerce – Communications and Networks: Communications – Uses of Computer Communications – Networks – Communication software – Communication devices – Communications Channel – Physical transmission media and Wireless transmission media.

<b>Unit - V</b>	<b>Database Management</b>	<b>12 Hours</b>
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Databases, Data and Information, The Hierarchy of data – Maintaining data – File processing versus databases – database management systems – relational, object oriented and multi - dimensional databases – web databases – database administration. Computer Security: Computer security risks – Internet and network attacks –Unauthorized access and use.

### Text Book(s):

1. Gary B. Shelly, Thomas. Cushman, Misty E. Vermaat, "Introduction to Computers, "Cengage Learning, 2008

### Reference Books:

1. Reema Tarija, "Fundamentals of Computers", Oxford Univ. Press,2015
2. Deborah Morley, Charles Sparker, "Understanding Computers-Today and Tomorrow",14th Edition, Thomson Course Technology, 2012
3. Alexis Leon, Mathew's Leon, "Fundamentals of Computer Science and Communication Engineering", Vikas Publishing House, New Delhi, 1998.

### Web Resources:

1. <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs17/>
2. [https://www.mooc-list.com/tags/fundamentals of computer](https://www.mooc-list.com/tags/fundamentals%20of%20computer)

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

### Learning Outcomes:

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

COs	Statements	Bloom's Level
CO1	Know the basics and internal parts of Computers	K1
CO2	Gain the knowledge on OS and its types	K2
CO3	Understand the basics of networks and Internet	K3
CO4	Learn the databases and DBMS concepts	K4
CO5	Understand the role of RDBMS in IT	K5

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

Mapping (COs vs POs)									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	S	S	S	S	S	S	S	M	S
CO3	S	S	S	S	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	S
CO5	S	S	S	S	S	S	S	M	S

S - Strong, M – Medium, L – Low

Semester: III	Course Code: 23PCA06	Hours/Week: 5	Credit: 5
<b>COURSE TITLE: CORE - VI ADVANCED JAVA PROGRAMMING</b>			

#### Course Overview:

1. Advanced Java, beyond its foundational concepts, comprises a sophisticated set of programming principles and techniques for building robust, scalable, and enterprise-level applications. It includes advanced topics such as multithreading, networking, database connectivity, and frameworks like Spring and Hibernate

#### Learning Objectives:

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

<b>Unit - I</b>	<b>An Overview of Java, Operators</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>String Handling, Input/output</b>	<b>10 Hours</b>
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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.

<b>Unit - III</b>	<b>The Applet Class</b>	<b>10 Hours</b>
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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.

<b>Unit - IV</b>	<b>Java Beans, Servlets</b>	<b>10 Hours</b>
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Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API, A Bean, Servlets: Life Cycle Simple Servlet - Servlet API – Packages - Cookies session tracking.

<b>Unit - V</b>	<b>Network Programming</b>	<b>10 Hours</b>
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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 Book(s):**

1. Herbert Scheldt, Java the Complete Reference, 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goodies, Starting out with Java from Control Structures through Objects 6th Edition, Pearson Education Limited, 2016.

**Reference Books:**

1. Herbert Scheldt, 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.

**Web Resources:**

1. <https://www.udemy.com/course/advanced-java-programming/>
2. <https://www.codecademy.com/learn/learn-advanced-java>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
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 (COs vs POs)**

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

S - Strong, M – Medium, L – Low

<b>Semester: III</b>	<b>Course Code: 23PCA07</b>	<b>Hours/Week: 5</b>	<b>Credit: 5</b>
<b>COURSE TITLE: CORE - VII WEB TECHNOLOGY</b>			

**Course Overview:**

1. Web technology refers to the means by which computers communicate with each other using markup languages and multimedia packages. It gives us a way to interact with hosted information, like websites. Web technology involves the use of hypertext markup language (HTML) and cascading style sheets (CSS).

**Learning Objectives:**

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

<b>Unit - I</b>	<b>Web Fundamentals and HTML</b>	<b>10 Hours</b>
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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.

<b>Unit - II</b>	<b>Introduction to XHTML and Css</b>	<b>10 Hours</b>
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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.

<b>Unit - III</b>	<b>The Basics of JavaScript, JavaScript and XHTML Documents</b>	<b>10 Hours</b>
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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. 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.

<b>Unit - IV</b>	<b>Dynamic Documents with JavaScript and XML</b>	<b>10 Hours</b>
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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.

<b>Unit - V</b>	<b>PHP, Angular JS and JQuery</b>	<b>10 Hours</b>
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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 Book(s):**

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. UNITS: 1,2,3,4
2. Dayley Brad, Dayley Brendan ,|Angular, 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, 3rdEdition, Wiley India, 2009.
2. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression, 2012.
3. Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.

#### **Web Resources:**

1. [https://archive.uneca.org/sites/default/files/uploaded-documents/SROs/SA/GIS SP2018/introduction\\_to\\_web\\_technology.pdf](https://archive.uneca.org/sites/default/files/uploaded-documents/SROs/SA/GIS%20SP2018/introduction_to_web_technology.pdf)
2. <https://www.scaler.com/topics/web-technology/>



**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
CO1	Design dynamic web pages using JavaScript, JQuery and Angular Java script	K1
CO2	Develop Web pages using HTML, CSS and XML	K2
CO3	Create web application using PHP and MySQL	K3, K4
CO4	To design dynamic web pages using Angular JavaScript	K2,K3
CO5	Develop interactive web pages using JQuery	K4,K5

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

**Mapping (COs vs POs)**

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

**S - Strong, M – Medium, L - Low**

<b>Semester: III</b>	<b>Course Code: 23PCA08</b>	<b>Hours/Week: 5</b>	<b>Credit: 5</b>
<b>COURSE TITLE: CORE - VIII ADVANCED MACHINE LEARNING</b>			

**Course Overview:**

1. The area of Machine Learning deals with the design of programs that can learn rules from data, adapt to changes, and improve performance with experience.

**Learning Objectives:**

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

<b>Unit - I</b>	<b>Introducing Machine Learning, Managing and Understanding Data</b>	<b>10 Hours</b>
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**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.

<b>Unit - II</b>	<b>Classification Using Nearest Neighbors, Decision Trees and Rules</b>	<b>10 Hours</b>
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Lazy Learning – Classification Using Nearest Neighbors: The kNN Algorithm - Diagnosing Breast Cancer with the kNN Algorithm - Probabilistic Learning – Classification Using Naïve, 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.

<b>Unit - III</b>	<b>Regression, Black Box Methods Neural Networks and Support Vector Machines</b>	<b>10 Hours</b>
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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 Back propagation - 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.

<b>Unit - IV</b>	<b>Clustering with K - Means, Improving Model Performance</b>	<b>10 Hours</b>
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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.

<b>Unit - V</b>	<b>Introduction to Deep Learning, Convolutional Neural Networks</b>	<b>10 Hours</b>
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**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 .

**Text Book(s):**

1. Brett Lantz, —Machine learning with R, Addison-Wesley Packt Publishing, 2013.
2. Taweh Beysolow, —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. Brett 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.

**Web Resources:**

1. [https://www.pega.com/ai-machine-learning?utm\\_source=google&utm\\_medium=cpc&utm\\_campaign=G\\_India\\_NonBrand\\_AI\\_CE\\_Exact\\_\(CPN111067\)\\_EN&utm\\_term=advanced%20machine%20learning&gclid=9148782&utm\\_content=pcrid%7C690635865303%7Cpkw%7Ckwd-330854401084%7Cpmt%7Ce%7Cpdv%7Cc%7C&gad\\_source=1&gclid=EAIAIQobChMI9vKV28fYhAMVqA6DAx2sWgc5EAAYAiAAEgKK-fD\\_BwE&gclidsrc=aw.ds](https://www.pega.com/ai-machine-learning?utm_source=google&utm_medium=cpc&utm_campaign=G_India_NonBrand_AI_CE_Exact_(CPN111067)_EN&utm_term=advanced%20machine%20learning&gclid=9148782&utm_content=pcrid%7C690635865303%7Cpkw%7Ckwd-330854401084%7Cpmt%7Ce%7Cpdv%7Cc%7C&gad_source=1&gclid=EAIAIQobChMI9vKV28fYhAMVqA6DAx2sWgc5EAAYAiAAEgKK-fD_BwE&gclidsrc=aw.ds)
2. <https://ml2.inf.ethz.ch/courses/aml/>

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

<b>Learning Outcomes:</b> Upon successful completion of this course, the student will be able to:		
<b>COs</b>	<b>Statements</b>	<b>Bloom's Level</b>
CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data	K1-K6
CO2	To comprehend, apply and evaluate the classification techniques for real-world applications	K1-K6
CO3	To understand, use and perform evaluation of Regression methods	K1-K6
CO4	To recognize, implement and analyses the unsupervised techniques for real-world applications	K1-K6
CO5	To understand, identify, implement and review the deep learning techniques for real-time applications	K1-K6
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

<b>Mapping (COs vs POs)</b>										
	<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>CO1</b>	S	S	-	-	S	L	-	S	-	-
<b>CO2</b>	S	S	M	-	S	L	-	S	-	-
<b>CO3</b>	S	S	S	-	S	L	-	S	-	S
<b>CO4</b>	S	S	M	-	S	L	-	S	-	-
<b>CO5</b>	S	S	S	-	S	L	-	S	-	S

**S - Strong, M – Medium, L – Low**

<b>Semester: III</b>	<b>Course Code: 23PCANMEP01</b>	<b>Hours/Week: 2</b>	<b>Credit: 2</b>
<b>COURSE TITLE: NON MAJOR ELECTIVE LAB I - INTEGRATED TECHNOLOGY(AML) LAB</b>			

**Course Overview:**

1. To formulate machine learning problems corresponding to different applications.
2. To understand a range of machine learning algorithms along with their strengths and weaknesses.
3. To apply machine learning algorithms to solve problems of moderate complexity.
4. To apply CNN to solve problems of moderate complexity.
5. To apply LSTM and RNN to solve problems.

**Learning Objectives:**

1. To recognize and develop the machine learning models through python in built functions.
2. To comprehend, impart and implement the deep learning models for real-time applications.
3. To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming.
4. To identify and evaluate the performance machine learning models for real-time dataset.
5. To understand, impart and develop the machine learning models for real-time dataset.

<b>EXERCISE No</b>	<b>LAB EXERCISES</b>	<b>Required Hours (30 Hours)</b>
1	Write a python program to compute the Central Tendency Measures: Mean Median, Mode, and Measure of Dispersion: Variance, Standard Deviation.	4
2	Implement a Linear Regression and Multiple Linear Regressions with a Real Dataset.	3
3	Implementation of Logistic Regression using sklearn.	2
4	Implement a binary classification model.	2
5	Classification with Nearest Neigh bours and Naïve Baye Algorithm	4
6	Implementation Decision tree for classification using sklearn and its parameter tuning.	3

7	Implement the k-means algorithm.	2
8	Implement an Image Classifier using CNN in Tensor Flow/Keras.	3
9	Implement an Auto encoder in Tensor Flow/Keras.	3
10	Implement a Simple LSTM using Tensor Flow/Keras.	4

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
CO1	To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming.	K1- K6
CO2	To recognize and develop the machine learning models through python in built functions.	K1- K6
CO3	To understand, impart and develop the machine learning models for real-time dataset.	K1- K6
CO4	To comprehend, impart and implement the deep learning models for real-time applications.	K1- K6
CO5	To identify and evaluate the performance machine learning models for real-time dataset.	K1- K6
K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create		

<b>Mapping (COs vs POs)</b>										
<b>CO/PSO</b>	<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>CO1</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>-</b>	<b>S</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>M</b>	<b>-</b>
<b>CO2</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>-</b>	<b>S</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>M</b>	<b>-</b>
<b>CO3</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>-</b>	<b>S</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>M</b>	<b>S</b>
<b>CO4</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>-</b>	<b>S</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>M</b>	<b>-</b>
<b>CO5</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>-</b>	<b>S</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>M</b>	<b>S</b>

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

<b>Semester: III</b>	<b>Course Code: 23PCAP02</b>	<b>Hours/Week: 3</b>	<b>Credit: 3</b>
<b>COURSE TITLE: CORE LAB - II ADVANCED JAVA PROGRAMMING LAB</b>			

**Course Overview:**

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

**Learning Objectives:**

1. Develop Servlets and JSP for creating Web based applications
2. Implement classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
3. Apply Applets and Swing programs



### List of Programs

EXERCISE No	LAB EXERCISES	Required Hours (20 Hours)
1	Implementation of and Exception handling concepts with different type of Exception.	2
2	Build a Swing application to implement metric conversion.	2
3	Use Grid Layout to design a calculator and simulate the functions of a simple calculator.	2
4	Create a Color palette with a matrix of buttons using Applet.	2
5	To invoke a servlet from HTML forms.	2
6	To invoke servlet from Applets.	2
7	To invoke servlet from JSP.	2
8	Implement message communication using Network Programming.	2
9	Write a program to connect databases using JDBC.	2
10	Implementation of Java Beans.	2

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

### Learning Outcomes:

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

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

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

Mapping (COs vs POs)										
CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	S	S	M	M
CO2	S	M	S	M	M	L	S	M	S	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	S	M	M	S	M	M	S	S
CO5	S	S	S	S	L	M	S	M	M	M

S- Strong; M-Medium; L-Low

<b>Semester: III</b>	<b>Course Code: 23PCAP03</b>	<b>Hours/Week: 3</b>	<b>Credit: 3</b>
<b>COURSE TITLE: CORE LAB - III WEB TECHNOLOGIES LAB</b>			

#### Course Overview:

1. Learn how to create web pages using HTML, CSS and Java script.
2. Implement dynamic web pages using Java script, JQuery and Angular Java script.
3. To create web applications using PHP and MySQL.
4. Create web pages using XML and Cascading Style Sheets.
5. Create XML documents and Schemas.

#### Learning Objectives:

1. To design dynamic web pages using Angular java script
2. Create web application using PHP and MySQL
3. Develop interactive web pages using JQuery
4. Develop Web pages using HTML, CSS and XML
5. Design dynamic web pages using JavaScript, JQuery and Angular Java script

### List of Programs

EXERCISE No	LAB EXERCISES	Required Hours (20 Hours)
1	Develop a web page to display your education details in a tabular format.	2
2	Develop a web page to display your CV on a web page.	2
3	Design a Homepage having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links.	2
4	Design a web page to demonstrate the usage of inline CSS, internal CSS and external CSS.	2
5	Design an XML document and create a style sheet in CSS & display the document in the browser	2
6	Develop a web page to Create image maps.	2
7	Design a web page to perform input validation using Angular Java script	2
8	Develop a web page in PHP to fetch details from the database.	2
9	Design a web page to hide paragraph using JQuery	2
10	Create a web page and add Java script to handle mouse events and form events	2

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

**Learning Outcomes:**

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

COs	Statements	Bloom's Level
CO1	Design dynamic web pages using JavaScript, JQuery and Angular Java script	K1
CO2	Develop Web pages using HTML, CSS and XML	K2
CO3	Create web application using PHP and MySQL	K3, K4
CO4	Develop interactive web pages using JQuery	K2,K3
CO5	To design dynamic web pages using Angular java script	K4,K5

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

**Mapping (COs vs POs)**

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

S- Strong; M-Medium; L-Low

<b>Semester: III</b>	<b>Course Code: 23PCASECP01</b>	<b>Hours/Week: 2</b>	<b>Credit: 2</b>
<b>COURSE TITLE: SKILL ENHANCEMENT PROFESSIONAL COMPETENCY SKILL - DATA VISUALIZATIONS LAB</b>			

**Course Overview:**

1. To learn the basic functions and operations of Excel and tableau
2. To explore to design, build, and deploy various charts for applications,
3. To comprehend, design and deploy the label and heat map
4. To understand and deploy dashboard
5. To understand the functions of tableau for data process.

**Learning Objectives:**

1. Enable to create and apply dashboard for various data processing
2. Comprehend, create and deploy labels and map
3. Illustrate and apply data visualization tool data set
4. Gains knowledge to create and design various visualization tools in Excel and Tableau.
5. Enable to create and apply Spread sheet and Tableau for various data processing

Use the following Dataset

[http://www.tableau.com/sites/default/files/training/global\\_superstore.zip](http://www.tableau.com/sites/default/files/training/global_superstore.zip)

<b>EXERCISE No</b>	<b>LAB EXERCISES</b>	<b>Required Hours (20 Hours)</b>
1	Create Pie chart for Sales and Sales % by Country (sorted in descending order)	2 Hours
2	Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total)	2 Hours
3	Create Line char for Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)	2 Hours
4	Create Scatter chart for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)	2 Hours

5	Create heat map for Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)	2 Hours
6	Design and create the label for vendor list	2 Hours
7	Design and create the dash board	2 Hours
8	Implement the following using Tableau: Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)	2 Hours
9	Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)	2 Hours
10	Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)	2 Hours

**Teaching Methodology:** Videos, Audios, PPT, Role Play, Quiz, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

### Learning Outcomes:

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

COs	Statements	Bloom's Level
CO1	Enable to create and apply Spread sheet and Tableau for various data processing	K1-K6
CO2	Gains knowledge to create and design various visualization tools in Excel and Tableau.	K1-K6
CO3	Comprehend, create and deploy labels and heat map.	K1-K6
CO4	Enable to create and apply dashboard for various data processing	K1-K6
CO5	Illustrate and apply data visualization tool for any data set	K1-K6
K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create		

<b>Mapping (COs vs POs)</b>										
<b>CO/PSO</b>	<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>CO1</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>-</b>	<b>S</b>	<b>-</b>
<b>CO2</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>-</b>	<b>S</b>	<b>S</b>	<b>M</b>
<b>CO3</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>-</b>
<b>CO4</b>	<b>S</b>	<b>M</b>	<b>L</b>	<b>S</b>	<b>M</b>	<b>L</b>	<b>-</b>	<b>S</b>	<b>S</b>	<b>M</b>
<b>CO5</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>L</b>	<b>S</b>	<b>L</b>	<b>-</b>	<b>S</b>	<b>S</b>	<b>-</b>

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