A.V.V.M. Sri Pushpam College (Autonomous), Poondi – 613 503

PG & Research Department of Computer Applications
M.C.A. Programme in Computer Applications
OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM
SCHEME OF PROGRAMME AND SYLLABUS
(For the candidates admitted from 2023-2024 onwards)

Vision and Mission of the college

Vision

     To provide quality academic programmes and value oriented higher education to the rural community, equip them to encounter current regional, national and global demands upholding moral standards and intellectual competency.

Mission

- To provide conducive environment for quality teaching-learning process and innovative research.
- To bestow substantial educational experience that is intellectually, socially, and personally transformative.
- To strive to bring out the latent potentiality and core competency of the learners
- To foster the culture of research-based learning, independent academic inquiry by encouraging the students to involve in research activities ranging from hands on training, student projects, publications etc.,
- To nurture essential skills, competent minds and compassionate hearts.
- To impart a practical, demanding and overall development of the personality generated by love, consideration and care for the society.
- To serve the society by extending needful outreach programmes to the rural populace.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- Make the learners realise the transformative power of education.
- Acquire profound disciplinary, applied, integrative knowledge and intellectual competency and domain specific and generic skills.
- Pursue lifelong learning and generate innovative solutions for the problems at individual and social level.
- Create a collaborative and inclusive environment, and serve the betterment of the society with moral integrity.
- Motivate to become a committed professional with necessary ethics as a leader as well as a team player.

PROGRAMME OUTCOMES for M.C.A. Programme

PO1: Problem Solving Skill: Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.

PO2: Decision Making Skill: Foster analytical and critical thinking abilities for data-based decision-making.

PO3: Ethical Value: Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.

PO4: Communication Skill: Ability to develop communication, managerial and interpersonal skills.

PO5: Individual and Team Leadership Skill: Capability to lead themselves and the team to achieve organizational goals.

PO6: Employability Skill: Inculcate contemporary business practices to enhance employability skills in the competitive environment.

PO7: Entrepreneurial Skill: Equip with skills and competencies to become an entrepreneur.

PO8: Contribution to Society: Succeed in career endeavors and contribute significantly to society.

PO9: Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective.

PO10: Moral and Ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life.

PROGRAMME SPECIFIC OUTCOMES for M.C.A Programme

PSO1: Placement: To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2: Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

PSO3: Research and Development: Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4: Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5: Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Internship/ Industrial Activity:

Students must complete in-plant training in any industry or organization where a programme-related procedure is being used, and this training must be done during the summer vacation at the end of I Year. A minimum of 30 hours should be spent on training. Students must submit a report on their training together with a certificate from the relevant industry or organization authority.

Field visit / Hands on Training:

In order to achieve experiential learning, these programmes with a minimum of 15 hours of contact time are offered as Extra Credit Courses in the I Semester. Evaluation of visit report will be held at the end of II Semester.

Components of Evaluation:

Internal Marks   : 25
External Marks   : 75
Total   : 100

MOOC:

Massive Open Online Course is offered in the III and IV Semester as an Extra Credit Course. Students can avail any one or more of the courses available in MOOC to equip their skill and knowledge themselves. To receive the extra credit, students must provide their MOOC course completion certificate at the end of the second year.

Skill Enhancement courses (SEC) offered by the Mathematics Department:

1. Communicative Skill and Personality Development.
2. Mini Project
3. Integrated Technology(AML)Lab(Self-study)
4. Skill Enhancement Professional Competency Skill

MASTER OF COMPUTER APPLICATIONS (MCA) 2023 – 2024

COURSES	TOTAL NO OF COURSES	TOTAL MARKS	TOTAL CREDITS	CLASSIFICATION
Core	12	1200	57	✓
Elective	6	600	18	✓
Project	1	100	7	X
Soft Skill	4	400	8	✓
Total	**23**	**2300**	**90**	

M.C.A (MASTER OF COMPUTER APPLICATIONS) ONWARDS – 2023 – 2024

S. No.	Semester	Category	Course Code	Title of the Course	Maximum Marks			Minimum Marks for Pass			Hours/ Week	Credits
					CIA	EE	Total	CIA	EE	Total		
1	I	Core	23P1CAC1	Discrete Mathematics	25	75	100	10	30	50	6	5
2		Core	23P1CAC2	Linux and shell programming	25	75	100	10	30	50	6	5
3		Core	23P1CAC3	Python Programming	25	75	100	10	30	50	5	4
4		Elective	23P1CAEL1A/ 23P1CAEL1B	Data Engineering and Management Lab/ Architecture and Frameworks Lab	40	60	100	16	24	50	5	3
5		Elective	23P1CAEL2A/ 23P1CAEL2B	Software Development Technologies / Soft Computing	25	75	100	10	30	50	5	3
6		SS1	23P1CAS1	Communicative Skill and Personality Development	40	60	100	16	24	50	3	2
		Extra Credit		Universal Human Values and Ethics	-	-	-	-	-	-	-	-
7	II	Core	23P2CAC4	Data Structures and Algorithms	25	75	100	10	30	50	6	5
8		Core	23P2CAC5	Big Data Analytics	25	75	100	10	30	50	6	5
9		Core	23P2CACP1	Data Structures and Algorithms Lab	40	60	100	16	24	50	5	4
10		Elective	23P2CAEL3A/ 23P2CAEL3B	Internet of Things Lab/ Computer Vision Lab	40	60	100	16	24	50	5	3
11		Elective	23P2CAEL4A/ 23P2CAEL4B	Block chain Technologies / Cyber Security	25	75	100	10	30	50	5	3
12		SS2	23P2CAS2	Mini Project	40	60	100	16	24	50	3	2
		Extra Credit		Field visit / Hands on Training	-	-	-	-	-	-	-	-

S. No.	Semester	Category	Course Code	Title of the Course	Maximum Marks			Minimum Marks for Pass			Hours/ Week	Credits
					CIA	EE	Total	CIA	EE	Total		
13	III	Core	23P3CAC6	Advanced Java Programming	25	75	100	10	30	50	6	5
14		Core	23P3CAC7	Web Technology	25	75	100	10	30	50	6	5
15		Core	23P3CAC8	Advanced Machine Learning	25	75	100	10	30	50	6	5
16		core	23P3CACP2	Advanced Java Programming lab	40	60	100	16	24	50	6	4
17		Elective	23P3CAEL5A/ 23P3CAEL5B	Web Technology lab/ Dot Net Technologies lab	40	60	100	16	24	50	3	3
18		SS3	23P3CAS3	Integrated Technology (AML) Lab (self study course)	40	60	100	16	24	100	3	2
19	IV	Core	23P4CACP3	Industry Dynamics Technology Data visualization lab	25	75	100	10	30	50	6	5
20		Core	23P4CACP4	Big Data Analytics lab	25	75	100	10	30	50	6	5
21		Project	23P4CACPR	Project Viva voce	40	60	100	16	24	50	10	7
22		Elective	23P4CAEL6A/ 23P4CAEL6B	Social Networks lab High Performance Computing lab	40	60	100	16	24	50	4	3
23		SS4	23P4CAS4	Skill Enhancement Professional Competency Skill	40	60	100	16	24	50	4	2
				Total			**2300**					**90**

Mandatory Bridge Courses for Non-Computer Science Stream Students

S. No	Semester	Category	Course code	Course Title	Maximum marks			Minimum marks for pass			Hours/ week	Credits
					CIA	E.E	TOTAL	CIA	E.E	TOTAL		
1	I	BRIDGE COURSE	23P1CABC1	**C and C++ Programming**	25	75	100	10	30	50	5	5
2		BRIDGE COURSE	23P1CABCP1	**C and C++ Programming Lab**	40	60	100	16	24	50	5	5
3	II	BRIDGE COURSE	23P2CABC2	**Database Management Systems**	25	75	100	10	30	50	5	5
4		BRIDGE COURSE	23P2CABCP2	**DBMS Lab**	40	60	100	16	24	50	5	5
5	III	BRIDGE COURSE	23P3CABC3	**Advanced Operating System**	25	75	100	10	30	50	5	5
6		BRIDGE COURSE	23P3CABCP3	**Advance Operating System Lab**	40	60	100	16	24	50	5	5

M.C.A.

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	23P1CAC1	**Discrete Mathematics**	6	5

Nature of the Course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented		Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Relations**- Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations— Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function	15
II	**Mathematical Logic**-Logical connectives-**Wellformed 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	15
III	**Recurrence Relations**- Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations.**Permutations**-Cyclic permutation- Permutations with repetitions- permutations of sets with indistinguishable objects-**Combinations**- Combinations with repetition	15

IV	**Matrices-** special types of matrices-Determinants-Inverse of a square matrix-Cramer's rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems	15
V	**Graphs** -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs .complete graph-Bipartite graph. **Self study-**Hyper cube graph-Matrix representation of graphs.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:

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

General References:

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://www.studocu.com/in/document/hindustan-institute-of-technology-and-science/discrete-mathematics/discrete-mathematics-notes-unit-1-module-1-logics-and-proofs/25570836
2.https://www.tutorialsduniya.com/notes/discrete-mathematics-handwritten-notes/

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

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Course Outcomes

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

CO Number	CO Statement	Cognitive Level
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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 –**Analyze,**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	L	-	M	M	M	M	S
CO2	S	S	M	-	S	L	-	M	M	M	M	S
CO3	S	S	M	-	S	L	-	M	M	S	S	S
CO4	S	S	M	-	S	L	-	M	M	M	M	S
CO5	S	S	M	-	S	L	-	M	M	M	M	S

S- Strong; M-Medium; L-Low

M.C.A.

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	23P1CAC2	Linux and Shell Programming	6	5

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Basic bash Shell Commands:** Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. Basic Script Building:Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. Using Structured **Commands:**Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.(Book-1, Chapters: 3, 11, and 12)	15
II	**More Structured Commands:** Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.(Book-1, Chapters:	15

	13, 14, and 16)	
III	**Creating Functions:** Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.(Book-1, Chapters: 17, 18, and 19)	15
IV	**Regular Expressions:** Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. Advanced sed: Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. Advanced gawk: Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions. (Book-1, Chapters: 20, 21, and 22)	15
V	**Working with Alternative Shells:** Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh.**Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-**Self study:**Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.(Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14).	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:

1. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3rd Edition, 2015.

2. Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, Second Edition2018.

Reference Books:

1. ClifFlynt,SarathLakshman,ShantanuTushar, "Linux Shell Scripting Cookbook ", Packt 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 Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

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Web resources:
1.https://www.durgasoftonline.com/courses/Linux-with-Shell-Programming-Study-Material-5e87d53f0cf264ff8c59d5e4

2.https://www.durgasoftonline.com/courses/Linux-with-Shell-Programming-Study-Material-5e87d53f0cf264ff8c59d5e4

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

CourseOutcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**23P1CAC3**	**Python Programming**	**5**	**4**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented		Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Introduction : Fundamental ideas of Computer Science **-** Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop	15
II	Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions	15
III	Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism – 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	15

IV	Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The DataFrame - The Index Objects – Data Vizualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts	15
V	Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers . **Self study** Retrieving Objects – Building List and Detail Views.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:
1. K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020

Reference Books:
1. Antonio Mele, "Django 3 By Example", Third Edition, 2020

Web resources:
1.https://www.tutorialsduniya.com/notes/python-notes/
2. https://www.studocu.com/in/document/srm-institute-of-science-and-technology/python/python-programming-notes/18852481

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**23P1CAEL1A**	**Elective – I Data Engineering and Management Lab**	**5**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

- To acquire basic scripting knowledge in MongoDB
- To learn CRUD Operation on MongoDB database
- To comprehend MongoDB using DbVisualizer
- To be familiar with Zoho CRM features
- To customize your application using Zoho CRM

SYLLABUS	
SL.NO	**CONTENT**
1.	Write a script to create a MongoDB database and perform insert operation
2.	Write a MongoDB script to perform query operations
3.	Write a MongoDB Script to perform update operations
4.	Write a MongoDB Script to update documents with aggregation pipeline
5.	Write a MongoDB script to delete single and multiple documents
6.	Write a MongoDB script to perform string aggregation operations
7.	Design a Data Model for MongoDB using DbVisualizer
8.	Perform CRUD operations using DbVisualizer
9.	Create a Zoho CRM account and organize your Tasks, Meetings and Deals
10.	Create and maintain a project using Zoho CRM features

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Comprehend the scripting knowledge in MongoDB and perform basic operations in shell prompt	K1-K6
CO2	Implement, Create, Read, Update and Delete Operations on MongoDB database	K1-K6
CO3	Analyze MongoDB using DbVisualizer	K1-K6
CO4	Assess Zoho CRM features for managing the customer relationships	K1-K6
CO5	Create a customized application in Zoho CRM	K1-K6

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	23P1CAEL1B	Elective – I Architecture and Frameworks - Lab	5	3

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

Implement the following using Linux / Windows environments
1. Find the WebID profile document and display the necessary attributes

2. Set and access the primary authentications with account recovery mechanisms

3. Set and access the secondary authentications with account recovery mechanisms

4. Design authorization and web access control

5. Find the content representation

6. Reading resources from HTTP REST API and WebSockets API

7. Writing resources from HTTP REST API and WebSockets API

8. Data notification using Social Web App protocol

9. Managing subscriptions and friends list using Social Web App protocol

10. Managing list of followers and following list using Social Web App protocol

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create.

Mapping Course outcomes with Programme outcomes

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

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**23P1CAEL2A**	**Elective – II** **Software Development Technologies**	**5**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are:

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

	SYLLABUS	
Unit	**Content**	**No. of Hours**
I	**Implementing Microservices:** Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring.	15
II	**Azure Kubernetes Service (AKS):** Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implenting security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges.	15

	Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.	
III	**.NET DevOps for Azure:** DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.	15
IV	**Building the code:** Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.	15
V	**Introduction to APIs:** Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization **Self study** API Security: Request-based security, Authentication and authorization.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:
1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure- Designing, Developing, Deploying, and Monitoring, Apress, 2019.

2. Jeffrey Palermo , NET DevOps for Azure A Developer's Guide to DevOps Architecture the Right Way, Apress, 2019.

3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

Reference Books:

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

3. John Ferguson Smart,"Jenkins, The Definitive Guide", O'Reilly Publication, First Ediiton 2011.

Web Resources:

1. https://www.halvorsen.blog/documents/programming/software_engineering/resources /Software%20Development.pdf.

2. https://www.ibm.com/topics/software-development

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Out comes

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

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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**23P1CAEL2B**	**Elective – II** **Soft Computing**	**5**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**INTRODUCTION TO SOFT COMPUTING:** Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections-Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability-Hebb Network-Flowchart of Training Process-Training Algorithm.	15
II	**SUPERVISED LEARNING NETWORK** : Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network-Architecture-Flowchart for Training Process-Training Algorithm.	15

III	**UNSUPERVISED LEARNING NETWORK:** Associative Memory Networks - Auto Associative Memory Network-Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear AutoAssociative Memory-Kohonen Self-Organizing Feature Map-Architecture-Flowchart for Training Process-Training Algorithm.	15
IV	**INTRODUCTION TO FUZZY LOGIC:** Classical Sets –Operations on Classical Sets-Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations –Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-Center of Largest Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.	15
V	**GENETIC ALGORITHM**: Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming- **Self study-**Characteristics of Genetic Programming-Data Representation.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)
Textbook:
1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.

> **UNIT I:** Chapter 1: 2.1,2.3,2.4,2.5,2.6,2.7
> **UNIT II:** Chapter 2: 3.2,3.3,3.4,3.5,3.6
> **UNIT III:** Chapter 3: 4.3,4.4,4.7,5.3
> **UNIT IV:** Chapter 4: 7.2,7.3,8.4,9.3,9.4,10,10.2,10.3,10.4,11.4,12.8,14
> **UNIT V:** Chapter 5: 15,15.2,15.3,15.4,15.9,15.10

Reference Books:

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., &Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.

6. Jang, J. S. R., Sun, C. T., &Mizutani, E. (1997). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

Web Resources:
1.
https://www.cet.edu.in/noticefiles/274_soft%20computing%20LECTURE%20NOTES.pdf
2. https://sunilwanjarisvpcet.wordpress.com/soft-computing/
Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

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

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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CAC4**	**Data Structures and Algorithms**	**6**	**5**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Abstract Data Types:** Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays**: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps- Multi-Dimensional Arrays.	15
II	**Algorithm Analysis:** Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.	15
III	**Stacks, Queues, and Deques:** Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.	15
IV	**Priority Queues:** Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.	15
V	**Search Trees:** Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-**Self-Study**-Minimum Spanning Trees.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

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

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

Web resources:
1.https://www.geektonight.com/data-structures-and-algorithms-notes/

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

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

L - Low, M- Medium, S – Strong

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CAC5**	**Big Data Analytics**	**6**	**5**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

Unit	Content	No. of Hours
I	**Big Data and Analytics:** Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data.Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop.Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools.	15
II	**Technology Landscape:** NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem.	15
III	**Mongodb and Mapreduce Programming:** MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.	15
IV	**Hive:** Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub-Query – Joins – Aggregations - Group by and Having – RCFile -	15

	Implementation - Hive User Defined Function - Serialization and Deserialization.	
V	**Pig:** Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive.**Self study-Graph Algorithms:** Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:
1. Seema Acharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, First Edition,2015

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

Web resources:
  1.https://www.lpude.in/SLMs/Master%20of%20Computer%20Applications/Sem_2/DECAP456_INTRODUCTION_TO_BIG_DATA.pdf

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

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

CO Number	CO Statement	Cognitive Level
CO1	To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K1-K6
CO2	To collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.	K1-K6
CO3	To comprehend, implement and review the concepts of data science and big data analytics projects using MapReduce, and MongoDB	K1-K6
CO4	To understand, use and analyze the concepts of big data analytics projects using HIVE database.	K1-K6
CO5	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	K1-K6

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CACP1**	**Data Structures and Algorithms Lab**	**5**	**4**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

Implement the following problems using Python 3.4 and above

1. Recursion concepts.

    i) Linear recursion

    ii) Binary recursion.

2. Stack ADT.

3. Queue ADT.

4. Doubly Linked List ADT.

5. Heaps using Priority Queues.

6. Merge sort.

7. Quick sort.

8. Binary Search Tree.

9. Minimum Spanning Tree.

10. Depth First Search Tree traversal.

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

CourseOutcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

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

L - Low, M- Medium, S – Strong

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CAEL3A**	**Elective – III** **Internet of Things Lab**	**5**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

- To create IoT program to turn ON/OFF LED
- To implement IoT program for object detection
- To develop IoT programs for agricultural purpose
- To create web server program for local hosting
- To design IoT application for health monitoring

1. To develop an IoT program to turn ON/OFF LED light (3.3V)

2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)

3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)

4. To develop an IoT web server program for local hosting

5. To develop an IoT program using Soil Moisture Sensor

6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)

7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)

8. To develop an IoT program for Fire Detection (Home, Industry,etc.)

9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)

10. To develop an IoT program using Heartbeat Sensor

Web resources:
1.	https://www.studocu.com/in/document/galgotias-university/introduction-to-iot/iot-lab-notes-latest/17611291

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CAEL3B**	**Elective – III Computer Vision Lab**	**5**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

Implement the following problems using Python with Open CV:
Image Loading, Exploring, and displaying an Image.

1. Access and Manipulate of Image Pixels.

2. Image Transformations.

    i) Resizing

    ii) Rotation

3. Addition operation of Two Images.

4. Image filtering operations

    i) Mean Filtering
    ii) Gaussian Filtering

5. Image Binarization Using Simple Thresholding method.
6. Edge Detection operation using Sobel and Scharr Gradients.
7. Find Grayscale and RGB Histograms of an Image.
8. Segment an Image using K-means Clustering algorithm.
9. Write a program to classify an Image using KNN Classification algorithm.

Web resources:
1.https://www.cs.rug.nl/~michael/teaching/CompVis/cv_prakt.pdf

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
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 denoising algorithms	K1-K6
CO4	To design and develop the Image Segmentation using Edge detection and Histograms	K1-K6
CO5	To apply and analyze image clustering and classification algorithms	K1-K6

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	S	L	M	L	L	L	M	M	M	S	S	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	M	L
CO4	S	S	S	M	M	L	M	L	M	L	S	L
CO5	S	S	S	M	M	L	S	L	S	L	S	L

L - Low, M- Medium, S - Strong

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CAEL4B**	**Elective – IV** **Cyber Security**	**5**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are:

● To understand the basics of Cybercrime and Computer forensics with protecting mechanism

● To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines

● To gain the ability to understand the importance of cyber investigations with its functioning role and learn the basics of Wi Fi and its security measures

● To understand and learn the method of seize the digital evidence
● To learn and analyze the concepts of digital forensics with cybercrime prevention techniques

	SYLLABUS	
Unit	**Content**	**No. of Hours**
I	**Introduction to cybercrime:** Classification of cybercrimes – reasons for commission of cybercrime – malware and its type – kinds of cybercrime – authentication – encryption – digital signatures – antivirus – firewall – steganography – computer forensics – why should we report cybercrime – introduction counter cyber security initiatives in India – generating secure password – using password manager-enabling two-step verification – security computer using free antivirus.	15
II	Tips for buying online: Clearing cache for browsers – wireless LAN-major issues with WLAN-safe browsing guidelines for social networking sites – email security tips – introduction-smartphone security guidelines – purses, wallets, smart phones – platforms, setup	15

	and installation-communicating securely with a smartphone.	
III	Cyber investigation roles**:** Introduction – role as a cybercrime investigator – the role of law enforcement officers – the role of the prosecuting attorney – incident response: introduction-post mortem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting Wi-Fi transmission – Wi-Fi technology – Wi-Fi RF-scanning RF – eavesdropping on Wi-Fi – fourth amendment expectation of privacy in WLAN.	15
IV	Seizure of digital information: introduction – defining digital evidence – digital evidence seizure methodology – factors limiting the wholesale seizure of hardware – other options for seizing digital evidence – common threads within digital evidence seizure – determining the most appropriate seizure method– conducting cyber investigations–demystifying computer/cyber crime – IP addresses – the explosion of networking – interpersonal communication.	15
V	Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases of digital forensics-collection – examination-analysis – reporting – **Self-Study-**Cyber crime prevention: Introduction – crime targeted at a government agency	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:
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. SebastianKlipper,"CyberSecurity"
   ,EinblickfurWirtschaftswissenschaftlerFachmedien 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.https://www.geeksforgeeks.org/cyber-security-types-and-importance/

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12
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	M	L
CO4	S	M	L	S	M	L	S	M	-	M	-	-
CO5	M	S	M	L	S	L	M	S	-	S	-	-

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CAEL4A**	**Elective – IV** **Block chain Technologies**	**4**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Blockchain, Decentralization** **Blockchain :**The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Blockchain - Consensus - CAP theorem and blockchain. **Decentralization:** Decentralization using blockchain - Methods of decentralization -Routes to decentralization - Blockchain and full ecosystem decentralization - Pertinent terminology - Platforms for decentralization - Innovative trends.	15
II	**Public Key Cryptography, Consensus Algorithms and Smart Contracts** **Public Key Cryptography:** Asymmetric cryptography - Cryptographic constructs and blockchain technology. **Consensus Algorithms:** Introducing the consensus problem -Analysis and design - Classification - Algorithms - Choosing an algorithm. **Smart Contracts:** History - Definition - Ricardian contracts - Smart contract templates – Oracles - Deploying smart contracts – DAO.	15

III	**Bitcoin:** Bitcoin—an overview - Cryptographic keys - Transactions - Blockchain – Mining. **Bitcoin Network and Payments:** The Bitcoin network - Wallets - Bitcoin payments -Innovation in Bitcoin - Advanced protocols - Bitcoin investment and buying and sellingBitcoin. **Bitcoin Clients and APIs:** Bitcoin client installation - Experimenting further with bitcoin-cli - Bitcoin programming.	15
IV	**Alternative Coins:** Theoretical foundations - Difficulty adjustment and retargeting algorithms - Bitcoin limitations - Extended protocols on top of Bitcoin -Development of altcoins.**Ethereum: Ethereum –** an overview - Ethereum network - Components of the Ethereum ecosystem - EthereumVirtual Machine (EVM) - Smart contracts. - Blocks and blockchain - Wallets and client - Nodes and miners - APIs, tools, and DApps - Supporting protocols - Programming languages.	15
V	**Development Tools and Frameworks, Use Cases & Security** **Development Tools and Frameworks :**Languages - Compilers - Tools and libraries - Frameworks - Contract development and deployment - Layout of a Solidity source code file - Solidity language. **Use Cases:** IoT – Government - Health -Finance – Media. **Scalability and Other Challenges:** Scalability - Privacy - Security - Other challenges	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:
1. Imran Bashir, "Mastering Blockchain" Second Edition Packet Pugblisher.
 ISBN-978-78883-904-4
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies. Princeton University Press, 2016. ISBN 978-0691171692

Reference Books:

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

Web resources:

   1.https://www.blockchain-council.org/info/blockchain-study-material/

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software.

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Understand, apply and examine the characteristics of blockchain, bitcoin and consensus algorithm in centralized and decentralized methods.	K1-K6
CO2	Comprehend and demonstrate the application of hashing and public key cryptography in protecting the blockchain.	K1-K6
CO3	Understand and analyse the elements of trust in a Blockchain: validation, verification, and consensus.	K1-K6
CO4	Comprehend and evaluate the alternate coin, Ethereum and smart contract.	K1-K6
CO5	Grasp and apply the knowledge of Tools and languages for applications	K1-K6

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping Course outcomes with Programme outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CAC6**	**Advanced Java Programming**	**6**	**5**

Nature of the Course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need	√	Addresses Environment and Sustainability	
Skill development Oriented		Relevant to national need	√	Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays Primitive Types-Literals Variables - Type Conversion and Casting- Operators- Control Statements-Classes and Methods – Inheritance- Exception Handling.	15
II	String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces – File - Byte Streams - Character Streams	15
III	The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window – Passing Parameters. Introducing GUI Programming with Swing– Introducing Swing: Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.	15

IV	Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.	15
V	Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows **Self study-** Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:

1. Herbert Schildt, "Java the Complete Reference", 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.

2. Tony Goddis, "Starting out with Java from Control Structures Through Objects" 6th Edition, Pearson Education Limited, 2016.

General References:

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013

2. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi,2012.

Web resources:

1.https://enos.itcollege.ee/~jpoial/allalaadimised/reading/Advanced-java.pdf
2.https://www.docdroid.net/mY1yTPu/advancedjavaprogrammingbyuttamkumarroy-pdf

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 –**Analyze,**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CAC7**	**Web Technology**	**6**	**5**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**WEB FUNDAMENTALS AND HTML:** A Brief Introduction to the Internet - The World Wide Web - Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element.	15
II	**INTRODUCTION TO XHTML AND CSS:** Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML- Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The<span> and <div>tags, Conflict resolution.	15

III	THE BASICS OF JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts. **JAVASCRIPT AND XHTML DOCUMENTS**: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model.	15
IV	DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.	15
V	**PHP, ANGULAR JS AND JQUERY:** Introduction to PHP: Overview of PHP -General Syntactic Characteristics - Primitives, Operations, and Expressions - Output - Control Statements - Arrays - Functions - Pattern Matching - Form Handling - Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:
1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. **UNITS:** 1,2,3,4

2. Dayley Brad, Dayley Brendan ,"AngularJS, JavaScript, and jQuery All in One", Sams Teach Yourself 1st Edition, Kindle Edition, 2015.**UNIT**: 5

Reference Books:

1.M. Srinivasan: Web Programming Building Internet Applications,   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.
5.W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013
6.Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

Web resources:
1. https://www.geeksforgeeks.org/web-technology/
2. https://en.wikipedia.org/wiki/Web_resource

Pedagogy: Teaching / Learning methods:
Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CAC8**	**Advanced Machine Learning (AML)**	**5**	**6**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need	√	Addresses Environment and Sustainability	
Skill development Oriented		Relevant to national need	√	Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Introducing Machine Learning**:The Origins of Machine Learning, Uses and Abuses of Machine Learning _ Basics of Machine Learning Algorithm Model Works - Steps to apply Machine Learning - Choosing a Machine Learning Algorithm - Using Machine Learning concepts. **Managing and Understanding Data:** Data Structures, Vectors And Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.	15
II	Lazy Learning – **Classification Using Nearest Neighbors:**The kNN Algorithm- Diagnosing Breast Cancer with the kNN Algorithm- Probabilistic Learning – Classification Using Naive Bayes: Basic concepts of Bayesian Methods- The Naïve Bayes Algorithm- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm. Divide and Conquer – **Classification Using Decision Trees and Rules:**	15

	Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.	
III	Forecasting Numeric Data – **Regression Methods:**Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees. Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Backpropagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns – Market Basket Analysis Using Association Rules: Understanding Association Rules- Example – Identifying Frequently Purchased Groceries with Association Rules.	15
IV	Finding Groups of Data – **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- Beyond Accuracy – other Measures of Performance, Visualizing Performance Tradeoffs. Improving Model Performance: Tuning Stock Models for Better Performance-Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process- Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting- Random forests.	15
V	**Introduction to Deep Learning:** Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs),Restricted Boltzmann Machines (RBMs). **Convolutional Neural Networks (CNNs):** Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization- Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back-Propagation Through Time (BPPT)-Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs **Self study** Structural Damping Within RNNs, Tuning Parameter Update Algorithm.	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

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

Reference Books:
1. Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics", Second Ed., Wiley Publication, 2015.

2. Bertt Lantz, "Machine Learning with R: Expert techniques for predictive modeling", 3rd Edition, April 15,2019,

3. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals", Wiley Publication,2015.

Web resources:
1.https://techdocs.broadcom.com/us/en/symantec-security-software/endpoint-security-and-management/endpoint-security/sescloud/Glossary/advanced-machine-learning-aml-content-v123022868-d4155e40521.html
2.https://techdocs.broadcom.com/us/en/symantec-security-software/endpoint-security-and-management/endpoint-security/sescloud/Glossary/advanced-machine-learning-aml-content-v123022868-d4155e40521.html

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
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 analyse 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	S	S	-	-	S	L	-	S	-	-	-	-
CO2	S	S	M	-	S	L	-	S	-	-	-	-
CO3	S	S	S	-	S	L	-	S	-	S	S	S
CO4	S	S	M	-	S	L	-	S	-	-	-	-
CO5	S	S	S	-	S	L	-	S	-	S	S	S

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CACP2**	**Advanced Java Programming lab**	**6**	**4**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need	√	Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

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

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CAEL5A**	**Elective – V** **Web Technology lab**	**3**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

- Learn how to create web pages using HTML, CSS and Javascript.
- Implement dynamic web pages using Javascript, Jquery and Angular Java script
- To create web applications using PHP and MySQL
- Create web pages using XML and Cascading Style Sheets
- Create XML documents and Schemas.

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

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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 applications	K2,K3
CO5	To design dynamic web pages using Angular javascript	K4,K5

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create.

Mapping Course outcomes with Programme outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CAEL5B**	**Elective – V** **Dot Net Technologies Lab**	**3**	**3**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

- To get strong understanding of .NET Framework and C# programming.
- To get advanced programming skills in C# .NET OOPs Concepts
- To get advanced methods of manipulating data using Microsoft SQL Server.
- To get clear idea of how to developing real-time standalone, web applications using ASP .NET.
- To get clear understanding and get experience in Microsoft Azure.

SYLLABUS	
SL.NO	**CONTENT**
1.	Demonstrate method overloading and method overriding
2.	Class and Objects
3.	Multilevel Inheritance
4.	Interfaces
5.	Demonstrate multiple type of Exceptions
6.	Azure Storage Container Using the Microsoft Azure Storage Client Library
7.	Demonstrate Read and Write a Data using Random Access Files
8.	. Employee management database using LINQ
9.	Student management system using ASP.NET
10.	Demonstrates simple Universal App.

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Get a strong understanding of .NET Visual Studio platform	K1
CO2	Become a strong knowledge in C# .NET.	K2
CO3	Getting real-time application developing using .NET Cloud Technologies	K3, K4

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create.

Mapping Course outcomes with Programme outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CAS3**	**Integrated Technology (AML)lab**	**3**	**2**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives
The main objectives of this course are:

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

SYLLABUS	
SL.NO	**CONTENT**
1.	Write a python program to compute the Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation
2.	Implement a Linear Regression and Multiple Linear Regression with a Real Dataset
3.	Implementation of Logistic Regression using sklearn
4.	Implement a binary classification model
5.	Classification with Nearest Neighbours and NavieBaye Algorithm
6.	Implementation Decision tree for classification using sklearn and its parameter tuning
7.	Implement the k-means algorithm
8.	Implement an Image Classifier using CNN in TensorFlow/Keras.

9.	Implement an Autoencoder in TensorFlow/Keras
10.	Implement a SimpleLSTM using TensorFlow/Keras.

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)
Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

M.C.A.

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	23P4CACP3	**Industry Dynamics Technology-Data Visualization Lab**	6	5

Nature of the Course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

	SYLLABUS	
Unit	**List of Programs**	**No. of Hours**
1.	Create Pie chart for Sales and Sales % by Country (sorted in descending order)	15
2.	Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total)	
3.	Create Line char for Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)	15
4.	Create Scatter chart for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)	
5.	Create heat map for Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)	15

6.	Design and create the label for vendor list	
7. 8.	Design and create the dash board Implement the following using Tableau Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)	15
9. 10.	Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class) Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)	15

Pedagogy : Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software.

Course Outcomes

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

CO Number	CO Statement	Cognitive 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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 –** Analyze,**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	S	S	M	L	M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-
CO4	S	M	M	S	M	L	-	-	-	-	-	-
CO5	M	S	M	L	S	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	**23P4CACP4**	**Big Data Analytics Lab**	**6**	**5**

Nature of the Course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

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

SYLLABUS		
Unit	**List of Programs**	**No. of Hours**
1. 2.	Implement File System Shell Commands for HDFS in Hadoop Environment Write a Mapreduce program using single reduce function for finding Maximum and Minimum Number	15
3. 4.	Write a Mapreduce program using multiple reduce function for Word Count in an given Text document Implement the following using Pig Latin Input and Output Operations Relational Operations	15
5. 6.	Implement the following using Pig Latin User Defined Functions Advanced Relational Operations Write a Word Count program using Pig Latin Script	15
7. 8.	Write a program to find a maximum temperature using Pig Latin Script Implement the following using Hive commands Handling the Database Creating and Manipulating table	15

9.	Implement Simple Queries for database using Mongo	15
10.	.Implement Simple Queries for collections using Mongo	

Pedagogy : Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

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

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 –** Analyze,**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

M.C.A.

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	23P4CAEL6A	Elective- VI Social Networking Lab	4	3

Nature of the Course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	√

Course Objectives
The main objectives of this course are:

- To familiarize the tools required to manage social network applications
- To analyze social networks like Facebook, LinkedIn, Google+, GitHub
- To get explore in the Github API.
- To enable students to have skills that will help them to solve real time applications.
- To teach the fundamental techniques and principles in achieving social networking environment.

	SYLLABUS	
Unit	**List of Programs**	**No. of Hours**
1.	Creating and Exploring Twitter's API	10
2.	To analyzing and visualizing tweets and tweet entities with frequency analysis	
3.	Creating and Exploring Facebook's Social Graph API	15
4.	To analyzing the Facebook's Social Graph connections	
5.	Creating and Exploring LinkedIn API	10
6.	To downloading LinkedIn connections as a CSV file	
7.	Creating and Exploring Google+ API	15
8.	To create and querying Human Language Data with TF-IDF	
9.	Creating and Exploring GitHub's API	10
10.	To analyzing GitHub interest graph	

Pedagogy : Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To understand , implement and review the fundamental techniques and principles for social networks.	K1-K6
CO2	To design and develop the programs using the tools required to develop and manage social network like Facebook, LinkedIn, Google+, GitHub	K1-K6
CO3	To create and explore the functionality of social networking tools such as GitHub	K1-K6
CO4	To understand , implement and review the fundamental principles for social network graph.	K1-K6
CO5	To comprehend and critically analyse the existing API for social networks	K1-K6

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 –** Analyze,**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12
CO1	S	S	M		M	S	-	-	-	S	-	-
CO2	S	M	S	S	S	M	-	-	-	S	-	-
CO3	S	S	S	S	S	S	-	-	-	S	S	S
CO4	S	M	S	S	S	M	-	-	-	S	-	-
CO5	S	S	S	S	S	S	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	23P4CAEL6B	**Elective- VI** **High Performance Computing Lab**	4	3

Nature of the Course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are:

- To understand concepts of High Performance Computing.
- To get brief knowledge about PB and Slurm.
- To understand techniques of OpenMP and OpenMPI.
- To understand Parallel computing concepts.
- To get familiar with CUDA.

SYLLABUS		
Unit	**List of Programs** (Implemented either PB, Slurm, OpenMP, OpenMPI, and CUDA)	**No. of Hours**
1. 2.	Demo: - Access and best practices on HPC Matrix multiplication with Job scheduling (PB or Slurm)	10
3. 4.	Vectors add with malloc shared Vector add program with MPI	15
5. 6.	Hello world task for Multithreading with openMP openMP shared memory on Host and Device	10
7. 8.	openMP Matrix Multiplication with parallelism and Barrier openMP with Reduction on operands and aggregate functionality	15
9. 10.	Vector and Matrix multiplication on CUDA Feed forward computing on CUDA	10

Pedagogy : Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar. Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Apply and Evaluate the HPC Programs	K1-K6
CO2	Design and Develop a MPI Programs	K1-K6
CO3	Design and Develop a different programming concepts of OpenMP	K1-K6
CO4	Develop an efficient PB and Slurm programming	K1-K6
CO5	Evaluate an efficient CUDA programming	K1-K6

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 –** Analyze,**K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**23P1CABC1**	**C and C++ Programming**	**5**	**5**

Nature of the course

Employability Oriented	√	To introduce various techniques for representation of the data in the real world	√	Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are to:

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
2. Understand dynamic memory management techniques using pointers, constructors, destructors, etc
3. Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
4. Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
5. Demonstrate the use of various OOPs concepts with the help of programs

UNIT	SYLLABUS Content	No. of Hours
I	**BASICS OF C PROGRAMMING** Data Types – Variables – Operators and Expressions – Conditional Statements – Control Statements – Arrays	15
II	**. ADVANCED C PROGRAMMING** Functions – Pointers – Structures and Union – Preprocessor Directives – File Handling.	15
III	Introduction to C++ - key concepts of Object-Oriented Programming – Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If ..else, jump, goto, break, continue, Switch case statements – Loops in C++ :for, while, do – functions in C++ - inline functions – Function Overloading.	15

IV	Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.	15
V	Operator Overloading: Overloading unary, binary operators – Overloading Friend functions –type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchical, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes..	15

Text Book:
1. Brian W. Kernighan, Dennis Ritchie, "The C Programming Language",   Second Edition, Pearson Education,2015.
2. Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 1999.
3.E. Balagurusamy, "Object-Oriented Programming with C++", TMH 2013, 7th Edition.

Reference Books:
1. Ashok N Kamthane, "Object-Oriented Programming with ANSI and Turbo C++", Pearson Education 2003.
2. Maria Litvin& Gray Litvin, "C++ for you", Vikas publication 2002.
3. Object-Oriented Programming Using C++ by Alok Kumar Jagadev , Amiya Kumar Rath , SatchidanandaDehuri , PHI Learning, 2017.

Web Resources:
1. https://alison.com/course/introduction-to-c-plus-plus-programming.
 2. https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/
3 https://www.w3schools.com/cpp/cpp_oop.asp

Pedagogy:Teaching/Learning Methods
1. Lecture   2. Tutorial   3. Assignment   4. PPT presentation
5. Seminar & Quizzes.

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

CO Number	CO Statement	Cognitive Level
CO1	Remember the program structure of C with its syntax and semantics	K1,K2,K3,K4
CO2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	K2,K3,K4,K5
CO3	Apply the programming principles learnt in real-time problems	K1,K3,K4,K6
CO4	Analyze the various methods of solving a problem and choose the best method	K2,K5,K6
CO5	Code, debug and test the programs with appropriate test cases	K3,K4,K5

Cognitive Level :K1 – Remember **; K2** –Understanding **; K3 –**Apply; **K4**- Analyze; **K5** –Evaluate **;K6** – Create ;

Mapping with Programme Outcomes:

PO \ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	3	3	3	2	3
CO 2	3	2	2	2	3	3	2
CO 3	2	2	3	3	2	3	3
CO 4	2	2	2	2	2	3	3
CO 5	3	3	3	3	3	3	2

3 - Strongly Correlated;   2 - Moderately Correlated; 1 - Weakly Correlated; 0 - No correlation.

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**20P1CABCP1**	**C and C++ Programming Lab**	**3**	**5**

Nature of the course

Employability Oriented	√	To introduce various techniques for representation of the data in the real world	√	Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are to:

- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
- Understand dynamic memory management techniques using pointers, constructors, destructors, etc
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
- Demonstrate the use of various OOPs concepts with the help of programs

SYLLABUS		
S.No	**Content**	**No. of Hours**
1.	Implementation of simple programs in C using Data types, Variables, Conditional and IterativeStatements.	5
2.	Implementation of simple programs in C using arrays andfunctions	5
3.	Implementation of simple programs in C using structures andunions.	5
4.	Implementation of simple programs in C usingpointers	5
5.	Write a C++ program to demonstrate function overloading, Default Arguments and Inline function.	5

6.	Write a C++ program to demonstrate Class and Objects	5
7.	Write a C++ program to demonstrate the concept of Passing Objects to Functions	5
8.	Write a C++ program to demonstrate the Friend Functions.	5
9.	Write a C++ program to demonstrate the concept of Passing Objects to Functions	5
10.	Write a C++ program to demonstrate Constructor and Destructor	5
11.	Write a C++ program to demonstrate Unary Operator Overloading	5
12.	Write a C++ program to demonstrate Binary Operator Overloading	5
13.	Write a C++ program to demonstrate: ● Single Inheritance ● Multilevel Inheritance ● Multiple Inheritance ● Hierarchical Inheritance ● Hybrid Inheritance	5
14.	Write a C++ program to demonstrate Virtual Functions.	5

Text Book:
1.E. Balagurusamy, "Object-Oriented Programming with C++", TMH 2013, 7th Edition.

Reference Books:
1. Ashok N Kamthane, "Object-Oriented Programming with ANSI and Turbo C++", Pearson Education 2003.
2. Maria Litvin& Gray Litvin, "C++ for you", Vikas publication 2002.
3. Object-Oriented Programming Using C++ by Alok Kumar Jagadev , Amiya Kumar Rath , SatchidanandaDehuri , PHI Learning, 2017.

Web Resources:
1. https://alison.com/course/introduction-to-c-plus-plus-programming.
2. https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/
3 https://www.w3schools.com/cpp/cpp_oop.asp

Pedagogy: Teaching/Learning Methods
1. Lecture
2. Tutorial
3. Assignment
4. PPT presentation
5. Seminar & Quizzes.

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Remember the program structure of C++ with its syntax and semantics	**K1, K2, K3, K4**
CO2	Understand the programming principles in C++ (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	**K2, K3, K4,K5**
CO3	Apply the programming principles learnt in real-time problems	**K1,K3, K4, K6**
CO4	Analyze the various methods of solving a problem and choose the best method	**K2,K5,K6**
CO5	Code, debug and test the programs with appropriate test cases	**K3, K4, K5**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	2	2	2
CO2	3	3	3	3	2	3	3
CO3	2	2	3	3	2	3	1
CO4	2	2	3	3	2	2	2
CO5	3	3	2	3	2	3	3

3 - Strongly Correlated;   2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CABC2**	**Database Management Systems**	**5**	**5**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

CourseObjectives

Themainobjectives ofthis courseare:

- To know about concepts and techniques to design DBMS..
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern DBMS.

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Introduction: Purpose of data base systems- View of data-Data models-Database Users and Administrators-Database Languages-Database Architecture-E-R Model:Basic concepts-Design isssues-Constraints- Keys-ER-Diagrams-weak Entity set-Extented E-R features-Reduction to E-R schema	15
II	Relational model: structure – Relational Algebra: Fundamental, Additional & Extended operations Modification – View - Other Relational Database - Tuple Relational Calculcus -Domain Relational Calculus	15
III	SQL-Basic Structure-Set operation-aggregate Functions- null values-nested sub queries-Derived Relations-view-modification of database-join relations-Advanced SQL-Embedded SQL-Advanced SQL Features.	15
IV	Advanced SQL: Domain Constraints-Referential integrity-assertion-Application Design and Development-triggers-RDB design-Decomposition using Functional Dependency-Normalization Units-F.D.	15
V	Indexing & Hashing-Basic concepts -Ordered indices-B++ tree index files-B tree index files-Static Hashing-Multiple Key Access-Comparison of ordered indexing and hashing- self study index definition in SQL..	15

*Note: Questions may be asked from the *Self-Study* content for only CIA test (Mid and End semesters) and **NOT** for the external (Semester Examinations)

Textbook:

    1."Database System concepts", Abraham Silber Schatz, Henk F.Korth, S.Sudarsan, Fifth Edition, 2006, McGraw Hill.

Reference Books:

1. Fred Mc Fadden, Jeffery A Hoffer, Mary B.prescott, "Modern Database Management", 5 Edition, Addison Wesley, 2000.
2. Elmasri, Navathe, "Fundamentals of Database System", Third Edition, Addison wesley, 2000.
3. Jefrey D.Ulman, Jenifer widomj, "A First Course in Database System", pearson Education Asia, 2001
4. Bipin c Desai, "An Introduction to Database System", Galgotia publications Pvt Limited, 2001.
5. Database System Concepts, C.J. Date. Seventh Edition, 1993.

Pedagogy: Teaching / Learning methods:

Chalk and Board, Virtual Class room, LCD projector, Video Conference, Guest Lectures, Tutorial, Assignment, Seminar.Library, Net Surfing, NPTEL Course Materials, Use of Mathematical software

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Model an application's data requirements using conceptual modeling and design database schemas based on the conceptualmodel.	K1-K5
CO2	Formulate solutions to a broad range of query problems using relational algebra/SQL.	K1-K5
CO3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of adatabase.	K1-K5
CO4	Run transactions and estimate the procedures for controlling the consequences of concurrent dataaccess.	K1-K5
CO5	Explain basic database storage structures, access techniques and queryprocessing.	K1-K5

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

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

L - Low, M- Medium, S – Strong

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23P2CABCP2**	**DBMS Lab**	**5**	**5**

Nature of the course

Employability Oriented	√	To introduce various techniques for representation of the data in the real world	√	Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are to:

- To know about concepts and techniques to design DBMS..
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern DBMS.

SYLLABUS		
S.No	**Content**	**No. of Hours**
1.	Library information processing.	5
2.	Students mark sheet processing.	5
3.	Telephone directory maintenance.	5
4.	Gas booking and delivering system.	5
5.	Electricity bill processing.	5
6.	Bank transaction (SB)	5
7.	Pay roll processing.	5
8.	Inventory.	5
9.	Question database and conducting quiz.	5
10.	Purchase order processing	5

Text Book:

1. "Database System concepts", Abraham Silber Schatz, Henk F.Korth, S.Sudarsan, Fifth Edition, 2006, McGraw Hill.

Reference Books:
6. Fred Mc Fadden, Jeffery A Hoffer, Mary B.prescott, "Modern Database Management", 5 Edition, Addison Wesley, 2000.
7. Elmasri, Navathe, "Fundamentals of Database System", Third Edition, Addison wesley, 2000.
8. Jefrey D.Ulman, Jenifer widomj, "A First Course in Database System", pearson Education Asia, 2001
9. Bipin c Desai, "An Introduction to Database System", Galgotia publications Pvt Limited, 2001.
10. Database System Concepts, C.J. Date. Seventh Edition, 1993.
   Dehuri , PHI Learning, 2017.

Pedagogy: Teaching/Learning Methods

1. Lecture   2. Tutorial   3. Assignment   4. PPT presentation
5. Seminar & Quizzes.

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Create databases with different types of keyconstraints.	**K1-K5**
CO2	Write simple and complex SQL queries using DML and DCLcommands.	**K1-K5**
CO3	Realize database design using 3NF andBCNF.	**K1-K5**
CO4	Use advanced features such as stored procedures and triggers and incorporate in GUI based applicationdevelopment.	**K1-K5**
CO5	Create XML database and validate with meta-data (XMLschema).	**K1-K5**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate;

Mapping of Course Outcomes with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	2	2	2
CO2	3	3	3	3	2	3	3
CO3	2	2	3	3	2	3	1
CO4	2	2	3	3	2	2	2
CO5	3	3	2	3	2	3	3

3 - Strongly Correlated;   2 - Moderately Correlated; 1 - Weakly Correlated;
 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	23P3CABC3	**Advanced Operating System**	5	5

Nature of the course

Employability Oriented	√	To introduce various techniques for representation of the data in the real world	√	Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need	√	Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are to:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture,
  Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To know the components and management aspects of Real time, Mobile operating systems

UNIT	SYLLABUS Content	No. of Hours
I	**FUNDAMENTALSOFOPERATINGSYSTEMS** Overview – Synchronization Mechanisms – Processes and Threads – Process1Scheduling Deadlocks: Detection, Prevention and Recovery – Models of Resources –Memory Management Techniques	15
II	**DISTRIBUTEDOPERATINGSYSTEMS** Issue in Distributed Operating System – Architecture – Communication Primitives –Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms –Agreement Protocols.	15
III	**DISTRIBUTEDRESOURCEMANAGEMENT** Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load	15

	Distributing –Scheduling Algorithms –Synchronous and Asynchronous Check Pointing and Recovery –Fault Tolerance –Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.	
IV	**REAL TIME AND MOBILE OPERATING SYSTEMS** Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.	15
V	**Linux System: Design Principles** - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System - Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer -Services Layer - Core OS Layer - File System.	15

Text Book:

1. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.

Reference Books:

1. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.

2. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.

3. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

Pedagogy: Teaching/Learning Methods

1. Lecture
2. Tutorial
3. Assignment
4. PPT presentation
5. Seminar & Quizzes.

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

CO Number	CO Statement	Cognitive Level
CO1	Discuss the various synchronization, scheduling and memory management issues•	K1,K2,K3,K4
CO2	Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of •	K2,K3,K4,K5
CO3	Distributed operating system Discuss the various resource management techniques for distributed systems•	K1,K3,K4,K6
CO4	Identify the different features of real time and mobile operating systems	K2,K5,K6
CO5	Modify existing open source kernels in terms of functionality or features used	K3,K4,K5

Cognitive Level :K1 – Remember **; K2** –Understanding **; K3 –**Apply; **K4**- Analyze; **K5** –Evaluate **;K6** – Create ;

Mapping with Programme Outcomes:

PO \ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	3	3	3	2	3
CO 2	3	2	2	2	3	3	2
CO 3	2	2	3	3	2	3	3
CO 4	2	2	2	2	2	3	3
CO 5	3	3	3	3	3	3	2

3 - Strongly Correlated;   2 - Moderately Correlated; 1 - Weakly Correlated;
0 - No correlation.

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23P3CABCP3**	**Advanced Operating System lab**	**5**	**5**

Nature of the course

Employability Oriented	√	To introduce various techniques for representation of the data in the real world	√	Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need		Addresses Environment and Sustainability	√
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are to:

- To learn the fundamentals of Operating Systems
- To implement basic services and functionalities of the operating system using system calls.
- To Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
- Implement memory management schemes ,file operation and page replacementschemes.

SYLLABUS		
S.No	**Content**	**No. of Hours**
1.	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.a) FCFS b) SJF	5
2.	Write a C program to simulate the MVT and MFT memory management Techniques.	5
3.	Write a C program to simulate the following file organization techniques a) Single level directory	5
4.	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	5
5.	Write a C program to simulate page replacement algorithms for Optimal	5
6.	Write a C program to simulate producer-consumer problem using semaphores	5
7.	Write a C programs to implement UNIX system calls and file management.	5

8.	Write C programs to simulate implementation of Disk Scheduling Algorithms: FCFS, SSTF.	5
9.	Write C programs to simulate Intra & Inter – Process Communication (IPC) techniques	5
10.	Implementation of the following File Allocation Strategies a) Sequential b) Indexed c) Linked	5

Text Book:
1. Operating System Concepts – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
2. Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson

Reference Books:
1. Operating Systems – Flynn, McHoes, Cengage Learning
2. Operating Systems – Pabitra Pal Choudhury, PHI
3. Operating Systems – William Stallings, Prentice Hall Database System Concepts, C.J. Date. Seventh Edition, 1993.Dehuri , PHI Learning, 2017.

Pedagogy: Teaching/Learning Methods
1. Lecture   2. Tutorial   3. Assignment   4. PPT presentation
5. Seminar & Quizzes.

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Compare the performance of various CPU Scheduling Algorithms	K1-K5
CO2	Analyze and simulate CPU Scheduling Algorithms	K1-K5
CO3	Implement memory management schemes and page replacement schemes.	K1-K5
CO4	Simulate file allocation and organization techniques.	K1-K5
CO5	Implement Deadlock avoidance and Detection Algorithms	K1-K5

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate;

Mapping of Course Outcomes with Programme Outcomes

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	2	2	2
CO2	3	3	3	3	2	3	3
CO3	2	2	3	3	2	3	1
CO4	2	2	3	3	2	2	2
CO5	3	3	2	3	2	3	3

3 - Strongly Correlated;   2 - Moderately Correlated; 1 - Weakly Correlated;
 0 – No correlation