

**CENTRAL UNIVERSITY OF KARNATAKA
KALABURAGI
SCHOOL OF COMPUTER SCIENCES**



COURSE STRUCTURE AND SYLLABUS

Master of Computer Applications (MCA)

(Effective from the academic year 2025 –26)

Department of Computer Science,
School of Computer Sciences,
Central University of Karnataka
Kalaburagi-585367

<p>CENTRAL UNIVERSITY OF KARNATAKA <i>(Established by an Act of the Parliament in 2009)</i> Kadaganchi, Kalaburagi – 585367, INDIA</p>		<p>Department of Computer Science School of Computer Science Kadaganchi, Aland Road, Kalaburagi District– 585367</p>
---	---	---

MASTER OF COMPUTER APPLICATIONS (MCA)

DEPARTMENT OF COMPUTER SCIENCE

The Department of Computer Science was established in 2012 in the School of Computer Science. Currently the Department of Computer Science offers a Master of Computer Applications (MCA).

ELIGIBILITY FOR ADMISSION

Candidates who have completed undergraduate degree from a recognized Indian or foreign university (foreign recognition to be decided as per AIU foreign equivalence list) in any discipline and secured a minimum of 50% aggregate (45% in case of SC/ST candidates) marks and having studied Mathematics / Computer Science as a main / optional subject at 10+2 level or undergraduate level and who have secured a minimum of 40% (35% in case of SC/ST candidates) marks in the entrance test conducted by the university.

DURATION OF COURSE

The course shall be of two years duration spread over four semesters. The maximum duration to complete the course shall be 4 years.

MEDIUM OF INSTRUCTION

The medium of instruction shall be English.

PASSING AND CLASSIFICATION

The minimum marks for passing and classification for the award of the MCA Degree shall be as per the existing norms of other PG degree courses of Central University of Karnataka, Kalaburagi.

OTHER PROVISIONS

All the other provisions relating to attendance, reappearance in examinations, repeal and saving clauses, removal of difficulties, etc., shall be as per the existing norms of other PG degree courses of Central University of Karnataka, Kalaburagi.

Vision Statement:

To groom the students technically competent and skilled intellectual professionals to address the challenges in the current computing arena arising in Software Industry, Academia and Research & Development laboratories.

Mission Statements:

MS-1. Excellence in Teaching and Research.

MS-2. Build highly skilled IT professionals.

MS-3. Interaction with Industries and Research organizations.

**School of Computer Sciences
Department of Computer Science**

Name of the Academic Program: Master of Computer Applications

Program Education Objectives (PEOs)

1. Produce knowledgeable and skilled human resources which are employable in IT and ITES.
2. Impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or applications.
3. Produce entrepreneurs who can develop customized solutions for small to large Enterprises.
4. To develop academically competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that compassionately foster the scientific temper with a sense of social responsibility.
5. To develop students to become globally competent.

1. Mapping Program Educational Objectives (PEOs) with Mission Statements (MS)

	MS-1	MS-2	MS-3
PEO-1	1	3	2
PEO-2	1	2	2
PEO-3	1	3	3
PEO-4	3	2	2
PEO-5	2	3	1

Program Outcomes (POs)

1. The understanding to apply knowledge of computing and technological advances appropriate to the Programme.
2. Skills to analyze a problem, and identify and define the logical modeling of solutions.
3. An ability to design, implement and evaluate a computer-based system, process, component, or Programme to meet stakeholder needs.
4. The ability to function effectively in teams to accomplish a common goal.
5. A sense of professional, ethical, legal, security and social issues and responsibilities.
6. Effectiveness in communicating with a wide range of audiences.
7. An ability to analyze the local and global impact of business solutions on individuals, organizations, and society.
8. An identification of the need to engage in continuing professional development.
9. An ability to provide solutions for research oriented problems.
10. Bridge the gap between industry and academia. Mapping of Program Outcomes (POs) with Program Educational Objectives

	PEO-1	PEO-2	PEO-3	PEO-4	PEO-5
PO-1	3	2	3	1	2
PO-2	2	3	2	1	2
PO-3	1	1	2	3	3
PO-4	2	1	2	3	2
PO-5	1	1	1	3	3
PO-6	2	2	2	3	3
PO-7	2	2	3	2	1
PO-8	1	1	1	2	2
PO-9	2	2	1	2	2
PO-10	1	1	1	2	2

CENTRAL UNIVERSITY OF KARNATAKA, KALABURAGI
Dept. of Computer Science

GENERAL COURSE STRUCTURE & THEME

Credit Distribution for MCA

Semester	DSC	DSEC	GE	EEC	Total
SEM I	15	4	3	-	22
SEM II	15	4	3	-	22
SEM III	15	5	-	2	22
SEM IV	5	5	-	12	22
Total	50	18	6	14	88

Discipline Specific Courses [DSC]

1. Number of Discipline Specific Courses: 10
2. Credits: 50

Sl. No.	Course Code	Course Title	Mode			Total Credits	Semester
			L	T	P		
1	PCACC11100	Computer Organization and Architecture	3	1	2	5	Semester I
2	PCACC11101	Python Programming	3	1	2	5	Semester I
3	PCACC11102	Data Structures And Algorithm	3	1	2	5	Semester I
4	PCACC21200	Advanced DBMS	3	1	2	5	Semester II
5	PCACC21201	Operating System	3	1	2	5	Semester II
6	PCACC21202	Digital Image Processing	3	1	2	5	Semester II
7	PCACC31300	Theory of Computation	3	1	2	5	Semester III
8	PCACC31301	Wireless Network and Mobile Computing	3	1	2	5	Semester III
9	PCACC31203	Advanced Software Engineering	3	1	2	5	Semester III
10	PCACC41500	Machine Learning	3	1	2	5	Semester IV
Total Credits						50	

Employment Enhancement Courses (EEC)

1. Number of Employment Enhancement Courses: 3
2. Credits: 14

Sl. No.	Course Code	Course Title	Mode			Total Credits	Semester
			L	T	P		
1	PCAPC31400	Mini Project	0	0	4	2	Semester III
2	PCAIC41400	Internship	-	-	-	2	Semester IV
3	PCARC41500	Dissertation Evaluation and Viva-voce	0	0	20	10	Semester IV
Total Credits						14	

COURSE STRUCTURE - FIRST YEAR MCA MASTER OF COMPUTER APPLICATIONS

Name of the School: Computer Sciences **Name of the Department:** Computer Science

Programme Code: MCA

I SEMESTER							
Sr. No	Course Type	Course code	Course Title	Mode			Credits
				L	T	P	
1	Discipline Specific Course	PCACC11100	Computer Organization and Architecture	3	1	2	5
2	Discipline Specific Course	PCACC11101	Python Programming	3	1	2	5
3	Discipline Specific Course	PCACC11102	Data Structures And Algorithm	3	1	2	5
4	Discipline Specific Elective	PCACL11XXX	Discipline Specific Elective I	3	0	2	4
5	Generic Elective		Generic Elective I (Opt from the other Departments)	3	0	0	3
Total				15	3	8	22
Discipline Specific Elective I Courses							
1	Discipline Specific Elective	PCACL11100	Discrete Mathematical Structure	3	0	2	4
2		PCACL11101	Probability and Linear Algebra				
3		PCACL11102	Operational Research				
4		PCACL11103	System Software				
5		PCACL11104	Web Programming				
Generic Elective for other Department Students							
1	Generic Elective: I	PCATG11100	Fundamentals of Computers and C programming	3	0	0	3
2		PCATG11101	Web Designing				

II SEMESTER							
Sr. No	Course Type	Course code	Course Title	Mode			Credits
				L	T	P	
1	Discipline Specific Course	PCACC21200	Advanced DBMS	3	1	2	5
2	Discipline Specific Course	PCACC21201	Operating System	3	1	2	5
3	Discipline Specific Course	PCACC21202	Digital Image Processing	3	1	2	5
4	Discipline Specific Elective	PCACL21XXX	Discipline Specific Elective II	3	0	2	4
5	Generic Elective		Generic Elective II (Opt from the other Departments)	3	0	0	3
Total				15	3	8	22
Discipline Specific Elective II Courses							
1	Discipline Specific Elective	PCACL21200	Advanced Data Structures and Algorithms	3	0	2	4
2		PCACL21201	Artificial Intelligence				
3		PCACL21202	Mobile Application Development				
4		PCACL21203	OOPs using Java				
5		PCACL21204	Information Retrieval Systems				
Generic Elective for other Department Students							
1	Generic Elective: II	PCATG21200	Introduction to Artificial Intelligence	3	0	0	3
2		PCATG21201	Introduction to Python				

COURSE STRUCTURE - SECOND YEAR MCA MASTER OF COMPUTER APPLICATIONS

Name of the School: Computer Sciences **Name of the Department:** Computer Science
Programme Code: MCA

III SEMESTER							
Sr. No	Course Type	Course code	Course Title	Mode			Credits
				L	T	P	
1	Discipline Specific Course	PCACC31300	Theory of Computation	3	1	2	5
2	Discipline Specific Course	PCACC31301	Wireless Network and Mobile Computing	3	1	2	5
3	Discipline Specific Course	PCACC31203	Advanced Software Engineering	3	1	2	5
4	Discipline Specific Elective	PCACL31XXX	Discipline Specific Elective III	3	1	2	5
5	Practical	PCAPC31400	Mini Project	0	0	4	2
Total				12	4	12	22
Discipline Specific Elective III Courses							
1	Discipline Specific Elective	PCACL31300	Cloud Computing	3	1	2	5
2		PCACL31301	Natural Language Processing				
3		PCACL31302	Modeling and Simulation				
4		PCACL31303	Fuzzy Sets and Fuzzy Logic				
5		PCACL31304	Pattern Recognition				
6		PCACL31305	Software Testing				

IV SEMESTER							
Sr. No	Course Type	Course code	Course Title	Mode			Credits
				L	T	P	
1	Discipline Specific Course	PCACC41500	Machine Learning	3	1	2	5
2	Discipline Specific Elective	PCACL41XXX	Discipline Specific Elective IV	3	1	2	5
3	Internship	PCAIC41400	Internship	-	-	-	2
4	Dissertation	PCARC41500	Dissertation Evaluation and Viva-voce	0	0	20	10
Total				6	2	24	22
Discipline Specific Elective IV Courses							
1	Discipline Specific Elective	PCACL41500	Big Data Analytics	3	1	2	5
2		PCACL41501	IoT and Its Applications				
3		PCACL41502	Cyber Security and Block Chain Technology				
4		PCACL41503	Deep Learning				
5		PCACL41504	Full Stack Development				
6		PCACL41505	Generative AI				

Internal assessment evaluation

- For the 5 credit course: 50 marks, 25 marks for Theory remaining 25 marks for practical, Internship has to be completed during vacation period (4 Weeks of Internship)

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- I

Computer Organization and Architecture			
Semester:	I	Internal Assessment	50
Course Code:	PCACC11100	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2.30
Credits: 5			

PREREQUISITE(S)

- The students should hold basic knowledge of Computers.
- The students should hold the skill set of basic Algebra.

COURSE OUTCOMES

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

CO-1: Summarize the concepts of Number system, Boolean algebra and Logic gates.
(Level 5: Evaluate)

CO-2: Experiment on Simplification of Boolean functions and Sequential Circuits.
(Level 4: Analyze)

CO-3: Prepare an architectural logic and control design for the processor. (Level 3: Apply)

CO-4: Describe the basic concepts of microprocessors. (Level 2: Understand)

CO-5: Discuss the structure of memory and its components. (Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Learning Outcomes (PLOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	3	2	2	1	1	2	2
CO2	2	2	2	3	2	2	2	2	3	3
CO3	2	2	2	2	2	2	1	3	3	3
CO4	1	1	1	3	1	1	1	2	2	2
CO5	3	2	2	2	2	2	1	3	3	3

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

DETAILED SYLLABUS

UNIT-I

15 hrs

Simplification of Boolean Functions: Introduction, Logic gates, Universal Gates, Boolean Expression, SOP, POS, Different types of map methods, Product of sum simplification, NAND or NOR implementation, Don't care condition, Tabulation method.

Combinational Circuits: Introduction, Half-adder, Full-Adder, Subtractors, Code conversion, Integrated circuits, Decoders, Decoder Expansion, Encoders, Multiplexers, Applications.

UNIT-II

15 hrs

Sequential Circuits: Flip-flops (SR, JK, D & T), Edge Triggering of Flip-Flops, Design of Sequential Circuits – Flip-Flop Input Equations, State Table, State Diagram, and Design Example.

Digital Components: Registers, Shift Registers, Counters, Binary Counter with Parallel Load, Memory Unit. Design of synchronous and asynchronous counters.

UNIT-III

15 hrs

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, Computer Registers, Common Bus System, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Program Interrupt, Design of Accumulator Logic.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Synchronous and Asynchronous Data Transfer, Handshaking, Modes of Transfer, Programmed I/O and Interrupt-initiated I/O, Priority Interrupt, Interrupt Cycle, Direct Memory Access (DMA), Serial Communication.

Memory System Design: Memory Organization, Memory Hierarchy, Main Memory (RAM/ROM chips), Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

UNIT-IV

15 hrs

Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws. (*For all algorithms or mechanisms, any one example is sufficient*).
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology, Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models. (*For all algorithms or mechanisms, any one example is sufficient*.)

Reference Books

1. M. Morris Mano (2007), *Computer System Architecture*, Prentice Hall.
2. William Stallings (2015), *COArchitecture Designing for Performance*, Pearson.
3. John P Hayes (1998), *Computer Architecture and Organization*, Tata McGraw Hill.
4. Bartee, T.C. (2001), *Digital Computer Fundamentals*, MC Graw Hill.
5. Mathur A.P. (1995), *Introduction to Microprocessors*, Tata Mc Graw Hill
6. Kai Hwang and Naresh Jotwani, *Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability*, McGraw Hill Education 3/e. 2015

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-I

Python Programming			
Semester:	I	Internal Assessment	50
Course Code:	PCACC11101	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2.30
Credits: 5			

PREREQUISITE(S)

- The students should hold fundamental knowledge of python.
- The students should hold the skill set of basic Mathematics.

COURSE OUTCOMES

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

CO1: To learn how to design object-oriented programs with Python classes.

CO2: To learn about reading, writing and implementing other operation on files in Python.

CO3: To implement threading concept and multithreading on Python

CO4: To design GUI Programs and implement database interaction using Python.

CO5: To know about use of regular expression and handling exceptions for writing robust python programs.

Mapping of Course Outcomes (COs) with Program Learning Outcomes (PLOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	3	2	2	1	1	2	2
CO2	2	2	2	3	2	2	2	2	3	3
CO3	2	2	2	2	2	2	1	3	3	3
CO4	1	1	1	3	1	1	1	2	2	2
CO5	3	2	2	2	2	2	1	3	3	3

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Python Language: Introduction to Python, Values and Variables-Integer and String Values-Identifiers-User Input-String Formatting, String Values, String Operations, String Slices, String Operators. Numeric Data Types, Conversions, Built-in Functions, Expressions and Arithmetic- Expressions, Arithmetic Examples. Control Flow and Syntax: Indenting, if Statement, If Else Statement, elif Statement, For Loops While Loops, While True Loops.

UNIT-II

15 hrs

Functions and Modules: Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function..

UNIT-III

15 hrs

Data structures: Lists , comprehensions and slicing, tuples, sets, dictionaries, Python libraries for data analysis: Numpy, Pandas, Matplotlib etc., Data manipulation and visualization using Pandas and Matplotlib, Iterators, Lambda expressions, filters, classes and modules. Tensors, multidimensional data, Scalar, Vector, Matrix, Shape of Tensor, Reshape, Transpose, Concatenation and stacking etc.

Reading data from various sources: CSV, files-text, JSON, URL, cloud storage etc.

UNIT-IV

15 hrs

Graphical User Interface in Python: Tkinter Basics

Basic numerical processing using Python: Introduction to numpy, Creation of vectors and matrices , Matrix manipulation.

Basing data analysis using Python: Introduction to Pandas, Pandas data structures – Series and DataFrame, Data wrangling using pandas, Loading a dataset into a dataframe, Selecting Columns from a dataframe, Selecting Rows from a dataframe, Adding new data in a dataframe, Deleting data from a dataframe.

Basic data visualization using Python: Introduction to Matplotlib, Scatter plot, Line plot, Bar chart, Histogram, Box plot.

Reference Books

1. Advanced Python Programming, Dr. Gabriele Lanaro, Quan Nguyen, Sakis Kasampalis, Packt Publishing, 2019
2. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018
3. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018
4. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress, 2017
5. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018
6. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to
7. Computer Science Using Python 3, Pragmatic Bookshelf, 3rd Edition, 2018
8. Programming through Python, M. T Savaliya, R. K. Maurya, G M Magar, Revised Edition, Sybgen Learning India, 2020

List of Experiments

1. Write a program to Python program to implement Basic python operations.
2. Write a program to Python program to implement various file operations.
3. Write a program to Python program to demonstrate use of regular expression for suitable application.
4. Write a Program to demonstrate concept of threading and multitasking in Python.
5. Write a Python Program to demonstrate different types of exception handling.
6. Write a GUI Program in Python to design application that demonstrates
 - a. Different fonts and colors
 - b. Different Layout Managers
 - c. Event Handling
 - d. GUI controls
 - e. Mini Project
7. Write Python Program to create application which uses date and time in Python.

8. Write a Python program to create server-client and exchange basic information
9. Write a program to Python program to implement concepts of OOP such as
 - a. Types of Methods
 - b. Inheritance
 - c. Polymorphism
10. Write a program to Python program to implement concepts of OOP such as
 - a. Abstract methods and classes
 - b. Interfaces
11. Programs on Tkinter, Numpy, Pandas and Matplotlib packages.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-I

Data Structures and Algorithms			
Semester:	I	Internal Assessment	50
Course Code:	PCACC11102	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	2:0:2	Exam Duration (Hours)	2.30
Credits: 5			

PREREQUISITE(S)

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

- The students should hold fundamental knowledge of Computers.
- The students should hold the skill set of basic Mathematics.

COURSE OUTCOMES

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

CO-1: Describe representation and functions of arrays. (Level 2: Understand)

CO-2: Analyze an algorithm for searching and sorting techniques in terms of time complexity (Level 4: Analyze)

CO-3: Use stacks, linear lists and queues. (Level 3: Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	1	--	--	--	--	1	--
CO2	3	2	3	1	2	2	1	--	2	--
CO3	2	3	2	2	1	--	3	1	2	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction and Array: Definition of data structure, data structure operations. Linear arrays, Representation of linear arrays in memory, traversing linear arrays, Inserting and Deleting, Multidimensional arrays: Representation of Two-Dimensional arrays in memory.

Stacks: Introduction, Array representation of stacks, Linked representation of stacks, Polish notation, Evaluation of a Postfix Expression, Transforming Infix Expressions into Postfix Expressions

Queues: Definition, Array representation of Queues, Linked representation of Queues, Circular queues, Priority Queue and D-Queue

UNIT-II

15 hrs

Linear List: Linked Lists, Representation of Linear Lists in memory, Traversing a Linked List, Searching a linked List, Insertion into a linked list, Deletion from linked list, Circular linked lists, Doubly linked lists and Header linked lists.

Trees: Introduction and Definition of Trees, Tree Terminology, Binary Tree, Representing Binary Tree in Memory, Traversing Binary Tree: Preorder, In-order, Post-ordered traversal, Manipulation of Binary trees and Binary Search Tree.

Graphs: Introduction, Graph theory terminology: Graph and multigraphs, Directed Graphs, Matrix representation of Graphs, Sequential representation of graphs: Adjacent matrix, traversing a graph: Breadth- First search, Depth First search and Spanning Tree.

UNIT-III

15 hrs

Introduction: Algorithm and It's Properties. Algorithm Specification-using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency.

Performance Analysis: Estimating Space complexity and Time complexity of algorithms.

Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ) with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.

Brute force design technique: Selection sort, sequential search, string matching algorithm with complexity Analysis

UNIT-IV

15 hrs

Divide and Conquer: Binary search, Merge sort, **Decrease and Conquer Approach:** Insertion sort **Greedy Method:** Knapsack Problem, **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm with performance analysis.

Single source shortest paths: Dijkstra's Algorithm. **All Pairs Shortest Paths:** Floyd's and Warshall Algorithm, **Backtracking:** N-Queens problem, **Branch and Bound:** Assignment Problem

Reference Books

1. Seymour Lipchutz (1986), *Theory and Problems of Data Structures*, Tata Mc Grew.
2. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein (2005), *Data structure using C and C++*, II Edition, PHI Publications.
3. Jean – Paul Tembley and Paul G. Sorenson (1983) *An Introduction to Data Structures with Applications*, II Edition, Tata Mc Graw Hill.
4. Srivastava S K (2011), *Data Structures Through C*, IInd Edition, BPB.
5. Reema Thareja (2015), *Introduction to C Programming*, IInd Edition, Oxford publication.
6. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
7. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
8. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
9. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- I

Discrete Mathematical Structures			
Semester:	I	Internal Assessment	40
Course Code:	PCACL11100	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2.00
Credits: 4			

PREREQUISITE(S)

None

COURSE OUTCOMES

After completion of course, students would be able to:

CO-1: Understand the basics of various discrete structures.

CO-2: Apply applications of discrete structures in Computer Science and Engineering.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	--	2	2	2	1	2	2
CO2	2	3	3	--	--	2	2	--	1	2

DETAILED SYLLABUS

UNIT-I

15Hrs

Mathematical Reasoning: Mathematical reasoning, Propositions, Negation, disjunction and conjunction, Implication and Equivalence, Truth tables, Predicates, Quantifiers, Natural deduction, Rules of Inference, Methods of proofs, Resolution principle, Application to PROLOG.

Set Theory: Paradoxes in set theory, Inductive definition of sets and proof by induction, Peano postulates,

UNIT-II

15Hrs

Relations, Properties of relations, Equivalence Relations and partitions, Partial orderings, Posets, Linear and well-ordered sets.

Combinatorics: Elementary Combinatorics, counting techniques, Recurrence relation, Generating functions

UNIT-III

15Hrs

Functions; mappings, Injection and Surjections, Composition of functions, Inverse functions, Special functions, Pigeonhole principle, Recursive function theory.

Graph Theory: Elements of graph theory, Euler graph, Hamiltonian path, trees, Tree traversals, Spanning trees, Representation of relations by graphs.

Reference Books

1. K. H. Rosen, Discrete Mathematics and applications, 6th Edition, Tata McGraw Hill 2007.
2. S.B. Singh, Discrete Structures/ 3rd Edition, Khanna Book Publishing, 2019.
3. S.B. Singh, Combinatorics and Graph Theory/ 3rd Edition, Khanna Book Publishing, 2018.
4. C. L. Liu, Elements of Discrete Mathematics, 2nd Edn., Tata McGraw-Hill 2000.
5. J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Second edition, Prentice Hall of India 1986.
6. W. K. Grassmann and J. P. Tremblay, Logic and Discrete Mathematics, A Computer Science Perspective, Prentice Hall Inc 1996

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- I

Probability and Linear Algebra			
Semester:	I	Internal Assessment	40
Course Code:	PCACL11101	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2.00
Credits: 4			

PREREQUISITE(S)

- The students should hold basic skills of Statistics and Mathematics.

COURSE OUTCOMES

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

CO-1: Explain the probability theory and its theorems. (Level 2: Understand)

CO-2: Compute the probability density function for the distributions (Level 3: Apply)

SO-3: Solve the real time problems using algebraic operations. (Level 3: Apply)

CO-4: Compute the Eigen value and Eigen vectors on real time requirements (Level 3: Apply)

CO-5: Discuss on matrix algebra and vector space (Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	--	--	--	--	2	--	2	--
CO2	3	2	2	--	--	--	2	--	2	--
CO3	3	2	2	--	--	--	3	--	2	--
CO4	3	3	2	--	--	--	2	--	2	--
CO5	3	2	1	--	--	--	1	--	3	--

DETAILED SYLLABUS

UNIT-I

15Hrs

Probability: Introduction to Probability Theory, Sample Spaces, Events, Axioms of Probability, Discrete Probability, addition and multiplication theorems on probability and complements of events, conditional probability, Bayes Theorem.

Random Variables and Distribution: Introduction to Random variables, Probability density functions and distribution functions, Marginal density functions, Joint density functions, mathematical expectations, moments and moment generating functions.

UNIT-II

15Hrs

Discrete probability distributions: Binomial, Poisson distribution, Continuous probability distributions: Uniform distribution and Normal distribution

Algebra: Fundamental operations in Algebra, expansion, quadratic equations, factorization, indices, logarithms, arithmetic, geometric and harmonic progressions, binomial theorem, permutations and combinations

Matrix Algebra: Introduction to Elementary transformations, inverse of a matrix, rank, solution of simultaneous linear equations, eigenvalues and eigenvectors, quadratic forms.

Vectors: Vectors and geometry in two and three space dimensions, Dot products and the norm of a vector. Important inequalities, vector spaces, subspaces and vector space axioms, Complex vector spaces.

Reference Books

1. Walpole, Myers Ye (2007), *Probability & Statistics for Engineers and Scientists*, Pearson Education.
2. T. Veerarajan (2002), *Probability, Statistics and Random Processes*, Tata McGraw – Hill.
3. Gilbert Strang (2016), *Introduction to Linear Algebra*, Wellesley-Cambridge Press.
4. David C. Lay, Steven R. Lay, Judi J. Macdonald, *Linear Algebra and Its Applications*, 5th Edition, Pearson.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- I

Operation Research			
Semester:	I	Internal Assessment	40
Course Code:	PCACL11102	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2: 00
Credits: 4			

PREREQUISITE(S)

- Students should have knowledge of basic mathematics.

COURSE OUTCOMES

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

CO-1. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.

CO-2. Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods,

CO-3. Model competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games

CO-4. Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems

CO-5. Optimize the allocation of resources to Demand points in the best possible way using various techniques

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

UNIT-II

15 hrs

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Assignment Problem- Formulation, Solutions to assignment problems by Hungarian method, Special cases

in assignment problems, unbalanced, Maximization assignment problems. Travelling Salesman Problem (TSP). Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.

UNIT-III

15 hrs

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models.

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games

Reference Books

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD. Publications, New Delhi – 2007
2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.
3. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt. Ltd. 2016.
4. Operations Research, Paneerselvan, PHI
5. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
6. Introduction to Operations Research, Hillier and Lieberman, 8th Ed., McGraw Hill

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- I

System Software			
Semester:	I	Internal Assessment	40
Course Code:	PCACL11103	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2.00
Credits: 4			

PREREQUISITE(S)

The students should hold knowledge of software and hardware.

COURSE OUTCOMES

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

- CO-1: Explain the concept of system software with real time examples. (Level 2: Understand)
- CO-2: Use of Loader and Linker in software system. (Level 3: Apply)
- CO-3: Describe the debugger architecture. (Level 2: Understand)
- CO-4: Discuss on microprocessor functions. (Level 2: Understand)
- CO-5: Distinguish between micro and macro processors. (Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	2	--	2	--	--	--	2	--
CO2	2	2	1	--	--	--	--	--	1	--
CO3	1	2	2	--	--	--	1	--	1	--
CO4	2	2	2	--	--	--	2	--	1	--
CO5	1	2	2	--	--	--	1	--	2	--

DETAILED SYLLABUS

UNIT-I

15Hrs

Introduction to system software: system programs, assembler, compiler, interpreter, operating system, Machine structure instruction set and addressing modes. Assemblers: basic assembler functions, machine dependent and machine independent assembler features, Assembler design two-pass assembler with overlay structure, one-pass assembler and multi-pass assembler.

UNIT-II

15Hrs

Loaders and linkers: basic loader functions, machine dependent and machine independent loader features, loader design linkage editors, dynamic linking and bootstrap loaders.

UNIT-III

15Hrs

Macro processors: basic macro processor functions, machine independent features, macro processor design recursive, one-pass macro processor, two-pass macro processor, general-purpose and macro processing with language translators.

Compilers: Basic Compiler functions, Machine-Dependent Compiler Features, Machine-Independent Compiler Features, Compiler Design Options.

Reference Books

1. Leland L. Beck (1996), *System Software: Introduction to System Programming*, 3rd Edition, Addison Wesley.
2. Damdhare (1987), *Introduction to System Software*, McGraw Hill.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- I

Web Programming			
Semester:	I	Internal Assessment	40
Course Code:	PCACL11104	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2.00
Credits: 4			

PREREQUISITE(S)

- The students should know the basic knowledge of computers.
- The students should be well versed in operating the web sites.

COURSE OUTCOMES

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

CO-1: Apply CSS features on creation of web pages. (Level 3: Apply)

CO-2: Demonstrating HTML concepts on portal design. (Level 3: Apply)

CO- 3: Describe web graphics operations for web designing. (Level 2: Understand)

CO- 4: Practice the HTML, CSS and Java script features on real time requirements. (Level 3: Apply)

CO- 5: Describe CSS grid Layout operations. (Level 2: Apply)

Mapping of Course Outcomes (COs) with Program learning Outcomes (PLOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1	1	1	1	1	1	1
CO2	3	3	3	2	2	2	2	1	1	1
CO3	3	3	3	2	3	2	2	1	1	1
CO4	3	2	2	1	2	2	1	2	1	1
CO5	2	3	3	3	1	2	1	2	2	2

DETAILED SYLLABUS

UNIT-I

15Hrs

Basics of HTML, XHTML, HTML5: Introduction, History of HTML, Structure of HTML Document: Text Basics, HTML Elements, Attributes HTML Headings, Paragraphs, HTML Formatting, Fonts, Styles, Images, Multimedia, Lists, Links, Document Layout, Creating Forms, Frames and Tables.

Cascading Style Sheets: Overview, Selectors and Declarations, Syntax for Color Values, Configure Inline CSS, Configure Embedded CSS, Configure External CSS, CSS Selectors: Class, Id, and Descendant, Span Element, Practice with CSS, The Cascade, Practice with the Cascade, CSS Syntax Validation.

UNIT-II

15Hrs

Graphics & Text Styling Basics: Web Graphics, Image Element, CSS Interactivity with Pseudo-Classes, Practice with CSS Two-Column Layout, CSS for Print, CSS Sprites,

JavaScript: Client-Side Scripting, JavaScripts, JavaScript Design Principles, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms,

UNIT-III

15Hrs

PHP: Program Control, Functions. Introduction to Server-Side Development with PHP, Server-Side Development, A Web Server's Responsibilities,

Server Side Scripting – Advantages of PHP – Installation & Configuration – PHP language elements - Data Types - Variables – Constants – Operators – Expressions - Control Structures - Arrays – Functions - Form Handling – Session – Cookie – page redirection – file uploading – file handling .

Reference Books

1. Terry Ann Felke-Morris, Basics of Web Design HTML5 and CSS, 5th Edition, Pearson.
2. Satish Jain, Shashank Jain (2010), Internet Technology and Web Design, BPB Publication.
3. Thomas Powell (2017), The Complete Reference: HTML & CSS, 5th Edition, McGraw Hill.
4. Lemay Laura (2016), Mastering HTML, CSS & Java Script, BPB Publications.
5. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-I

Fundamentals of Computers and C Programming			
Semester:	I	Internal Assessment	30
Course Code:	PCATG11100	End Sem. Exam	45
Teaching Hours/Week (L:T:P):	3:0:0	Exam Duration (Hours)	2
Credits: 3			

PREREQUISITE(S)

Students should have basic knowledge of Computers.

COURSE OUTCOMES

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

CO-1: Describe the basics of computers and number systems. (Level 2: Understand)

CO-2: Explain the network system and process of data. (Level 2: Understand)

CO-3: Discuss on features of windows operating system. (Level 2: Understand)

CO-4: Identify the services of the internet and its applications. (Level 2: Understand)

CO-5: Discuss types of Operating systems. (Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	1	--	--	--	--	1	--
CO2	3	2	3	1	2	2	1	--	2	--
CO3	2	3	2	2	1	--	3	1	2	--
CO4	2	2	2	1	2	--	1	1	2	2
CO5	2	3	2	2	1	--	3	1	2	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Basics of Computer: Definition, Characteristics of Computers, Applications of Computer, Generations of computers, Components of Computer System: Central Processing Unit (CPU), Input/output Devices, Computer Memory: primary and secondary memory, magnetic and optical storage devices, Concepts of Hardware and Software. Operating system and Microsoft Windows: Definition & functions, usage of Windows OS.

UNIT-II

15 hrs

Network and Internet: History and evolution of Computer Network, Types of network (LAN, MAN & WAN), Search engines, Types of Search engines, Internet, architecture of internet, advantages and disadvantages of internet and its applications.

Introduction to C, Structure of C program, Compilers, Compiling and executing C programs, variables, constants, Input/output statements in C. Operators in C , Type conversion and type casting

UNIT-III

15 hrs

Decision control and Looping statements: Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements, goto statement.

Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays.

Reference

Books

1. P.B.Kottur (2009), *Computer Concepts & C Programming*, Sapna Book House.
2. V. Rajaraman (2008), *Computer Fundaments*, Prentice Hall of India.
3. P.K. Sinha (1992), *Computer Fundamental*, Prentice Hall of India.
4. Libreoffice Documentation Team (2019), *Getting Started with LibreOffice 6.0*, Lulu.com.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-I

Web Designing			
Semester:	I	Internal Assessment	30
Course Code:	PCATG11101	End Sem. Exam	45
Teaching Hours/Week (L:T:P):	3:0:0	Exam Duration (Hours)	2
Credits: 3			

PREREQUISITE(S)

- The students should have basic knowledge of computers.
- The students should be well versed in operating the web sites.

COURSE OUTCOMES

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

- CO-1: Features for the Internet and World Wide Web. (Level 2: Understand)
- CO-2: Apply HTML concepts on portal design. (Level 3: Apply)
- CO-3: Apply CSS features on portal design. (Level 3: Apply)
- CO-4: Practice the HTML and CSS features on real time requirements. (Level 3: Apply)
- CO-5: Discuss CSS features. (Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	--	2	2	2	1	2	2
CO2	2	3	3	--	--	2	2	--	1	2
CO3	2	3	3	--	--	2	2	--	--	--
CO4	2	2	3	--	--	2	1	--	2	--
CO5	2	3	3	--	--	2	2	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Internet: Definition, History of the Internet, Internet Service Providers, Connection Types, Modems, DNS Servers, Internet connection using Dial-up Networking, Routers, Internet Addresses, Protocols of Internet

World Wide Web: Introduction, URL, web pages, web clients, web server, web Site Development, Web Content Authoring, Web Programming, Search Engines, Plug-ins, FTP Applications.

UNIT-II

15 hrs

Basics of HTML: Introduction, History of HTML, Structure of HTML Document: Text Basics, HTML Elements, Attributes HTML Headings, Paragraphs, HTML Formatting, Fonts, Styles, Images, Multimedia, Lists, Links, Document Layout, Creating Forms, Frames and Tables, Introduction to DHTML, Advantages of DHTML.

UNIT-III

15 hrs

Cascading Style Sheet: Properties: Using the style Attribute, Creating Classes and IDs, Generating External Style Sheets, Typography, Consistency, Types of styles, Specifying class within HTML document, Style placement: Inline style, Span & div tags, header styles, Text and font attributes: changing fonts, text attributes, Advance CSS properties: Backgrounds, Box properties and Positioning.

Reference Books

1. Satish Jain, Shashank Jain (2010), *Internet Technology and Web Design*, BPB Publication.
2. Thomas Powell (2017), *The Complete Reference: HTML & CSS*, 5th Edition, McGraw Hill.
3. Lemay Laura (2016), *Mastering HTML, CSS & Java Script*, BPB Publications.
4. Deborah J. Miller (2001), *Careers with Internet Service Providers*, Rosen Publishing Group.
5. Bryan Sullivan, Vincent Liu (2012), *Web Application Security, A Beginner's Guide*, McGraw Hill.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

Advanced DBMS			
Semester:	II	Internal Assessment	50
Course Code:	PCACC21200	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	150 Min
Credits: 5			

PREREQUISITE(S)

- Students should have the knowledge of data structures
- Students should know the concept of the file-handling

COURSE OUTCOMES

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

- CO1: Identify the difference between database systems from file systems and describe each in both function and benefit. (Level 1 Remember)
- CO2: Model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model. (Level 4 Analyze)
- CO3: Describe the concept of normalization theory for normalizing database. (Level 2 Understand)
- CO4: Explain the relational data model. (Level 2 Understand)
- CO5: Apply practical experience by designing and constructing data models using SQL. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1	1	1	1	1	1	1
CO2	3	3	3	2	2	2	2	1	1	1
CO3	3	3	3	2	3	2	2	1	1	1
CO4	3	2	2	1	2	2	1	2	1	1
CO5	2	3	3	3	1	2	1	2	2	2

DETAILED SYLLABUS

UNIT-I

15 hrs

Relational Databases: Introduction, Database System Applications, Data Abstraction, Instances and Schemas, Data Models, Database Architecture, Database Users and Administrators

Relational Model: Structure of Relational Database, database Schema, Keys, Relational Query language, The Relational Algebra: Fundamental Operations, Formal definition of the relational algebra, additional relational algebra operations.

Entity Relationship model: Entities, Attributes, Entity Sets, Relationships, Key Constraints, Participation Constraints, Weak Entities, UML Class Diagrams, Subclasses, Super classes, Specialization, Generalization, Constraints and Characteristics of Specialization and Generalization Hierarchies, Representing Specialization and Generalization in UML Class Diagrams.

UNIT-II

15 hrs

Database design Theory

Problems Related to Decomposition, Functional dependency, 1NF, 2NF, 3NF, BCNF, 4NF, Lossless Join Decomposition, Dependency Preserving Decomposition, Schema Refinement in Database Design, Multi Valued Dependencies.

UNIT-III

15 hrs

Parallel, Distributed Databases and Transaction Processing

Introduction, parallel database architecture, parallelizing individual operation, Parallel query Evaluation, Parallel Query Optimization, Distributed DBMS Architecture, storing data in distributed DBMS, Distributed Catalog Management, distributed query processing, Updating distributed data, distributed concurrency control, Distributed recovery.

Transaction Processing: Transaction Processing, Transactional Real-Time Transaction Systems, Long-Duration Transactions and Transaction Management in Multi-databases.

UNIT-IV

15 hrs

Databases for the WEB and Semi-Structured Data

Web interface, XML, structure of XML data, querying XML data, storage of XML data, XML applications, semi- structured data model, indexes for text data

Reference Books

1. Elmasri R and Navathe SB (2007), *Fundamentals of Database Systems*, 5th Edition, Pearson Education.
2. Connolly T, Begg C and Strachan A (1999), *Database Systems*, 2nd Edition, Addison Wesley.

3. Abrahamsi. Silberschatz, Henry. F. Korth, S. Sudarshan (2012), *Database System Concepts*, 6th Edition, McGraw Hill.
4. Silversatz, H. Korth and S. Sudarsan (2005), *Database Concepts*, 5th Edition, Mc-Graw Hills.
5. C.J. Date (2003), *Introduction to database systems*, 8th Edition, Addison Wesley.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

Operating System			
Semester:	II	Internal Assessment	50
Course Code:	PCACC21201	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	4:0:2	Exam Duration (Hours)	150
Credits: 5			

PREREQUISITE(S)

- The students should hold basic knowledge of computer systems.
- The students should have practical knowledge of working with computers.

COURSE OUTCOMES

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

CO-1: Review the basic concepts of operating systems. (Level 2: Understand)

CO-2: Illustrate the examples on shell programming and file structure. (Level 3: Apply)

CO-3: Justify the socket programming concepts for the comparison of standalone programming. (Level 5: Evaluate)

CO-4: Describe the operations on directories and its comparison in terms of performance. (Level 5: Evaluate)

CO-5: Review the file system and its protection mechanism. (Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	--	2	--	2	1	--	--	--
CO2	3	3	3	2	--	2	2	--	1	--
CO3	3	3	3	1	--	--	1	--	1	--
CO4	3	2	2	1	--	--	1	--	2	--
CO5	2	2	1	--	--	--	1	--	1	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Operating System: Operating systems concepts, types of operating systems, Evolution of operating systems, different views of the operating system, operating system services, System calls, Types of system calls, operating system structure, layered approach, Micro kernels and Virtual machines.

UNIT-II

15 hrs

Process Management: Process concept, operation on processes, Inter-process communication, mutual exclusion, process synchronization, Inter process synchronization, critical section problem, semaphores, process scheduling concepts, scheduling criteria, scheduling algorithms, deadlocks, system model, deadlock characterization, deadlock prevention, deadlock avoidance.

UNIT-III

15 hrs

Memory Management: Introduction, memory management, swapping, contiguous memory allocation, paging, segmentation, virtual memory, demand paging, page replacement algorithms: FIFO, Optimal, LRU, Counting based page replacement.

UNIT-IV

15 hrs

Disk Scheduling: Introduction, physical characteristics, disk scheduling algorithms, disk Management, RAID Structure.

File system: Files, access method, directory structure, protection and file system implementation, allocation methods.

CASE STUDY: Study of UNIX, LINUX, AND ANDROID Operating System

Reference Books

1. Beginning Linux Programming –Neil Mathew,Richard Stones 4th Edition,Wiley
2. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7 th Edition, John Wiley
3. Unix System Programming using C++, T.Chan,PHI.
4. Unix Concepts and Applications, 4th Edition, Sumitabha Das,TMH,2006.
5. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.
6. Operating Systems – Internals and Design Principles Stallings, Fifth Edition–2005, Pearson Education/PHI
7. Operating System A Design Approach- Crowley, TMH.
8. Modern Operating Systems, Andrew S. Tanenbaum 2 nd edition, Pearson/PHI
9. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
10. UNIX Internals -The New Frontiers, U. Vahalia, Pearson Education.

Practicals on Operating System

Hardware Requirement: Raspberry Pi-8, Digital 8086 Microprocessor Training Kit, Bare Metal Server, 8-Port Switch, Ethernet CAT-6 Cable

Software: Oracle Virtual Box, Windows OS, Linux OS, Android OS etc.

1. Write a simple program that prints "Welcome to Operating System" to understand the basic interaction with the operating system in Linux.
2. Write a program that creates a new process and prints the process ID of both the parent and child processes.
3. Implement a simulation of the fork() system call in a program and demonstrate process creation.
4. Write a program to demonstrate the termination of a process using the exit() system call.
5. Create a parent process that creates a child, and demonstrate zombie and orphan process behavior.
6. Write a program that creates, reads, writes, and deletes a file to demonstrate file handling in an OS.
7. Implement a basic memory allocation program that simulates memory allocation using techniques like First Fit, Best Fit, and Worst Fit.
8. Write a program that uses semaphores to solve a synchronization problem, such as the producer-consumer problem.
9. Write a program to simulate deadlock detection in an operating system by detecting circular waiting conditions.
10. Implement a program that creates multiple threads using the pthread library (in C) or threading module (in Python) to demonstrate basic threading concepts.
11. Write a program that uses mutexes to control access to a shared resource to avoid race conditions.

12. Write a basic simulation of a file system that implements operations like creating, deleting, and reading files.
13. Implement a simulation of paging and page replacement algorithms such as FIFO, LRU, or Optimal Page Replacement.
14. Implement and simulate CPU scheduling algorithms like FCFS, SJF, Round Robin, and Priority Scheduling.
15. Write a program to simulate disk scheduling algorithms such as FCFS, SSTF, SCAN, and C-SCAN.
16. Simulate the concept of virtual memory and address translation using page tables and segmentation.
17. Implement a simple command-line shell program that takes input from the user and executes system commands.
18. Write a program to handle Unix signals such as SIGINT (Ctrl+C) or SIGTERM.
19. Implement a solution for a classic synchronization problem (e.g., the dining philosophers problem) using threads and synchronization primitives.
20. Write a program to demonstrate Inter-Process Communication (IPC) using mechanisms like pipes, message queues, or shared memory.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

Digital Image Processing			
Semester:	II	Internal Assessment	50
Course Code:	PCACC31300	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	4:0:2	Exam Duration (Hours)	2.30
Credits: 5			

PREREQUISITE(S)

- Knowledge of python programming language.
- Knowledge of Mathematics.

COURSE OUTCOMES

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

CO-1. Review the fundamental concepts of a digital image processing system. (Level 2 Understand)

CO-2. Analyze images in the frequency domain using various transforms. (Level 4 Analyze)

CO-3. Apply the techniques for image enhancement and image restoration. (Level 3 Apply)

CO-4. Use morphological techniques on images. (Level 3 Apply)

CO-5. Employ image segmentation and representation techniques on images. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	1	1	1	2	3	3	2
CO2	3	2	1	1	1	2	2	3	2	2
CO3	3	2	3	1	1	2	2	3	1	2
CO4	2	3	3	1	2	1	2	1	2	3
CO5	2	3	2	1	1	2	1	1	2	3

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction: Digital image processing, Applications of digital image processing, Fundamental steps in digital image processing, and Components of an image processing system.

Digital image fundamentals: Image sampling and quantization, some basic relationships between pixels, Linear and nonlinear operation.

UNIT-II

15 hrs

Image enhancement in the spatial domain: Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Image enhancement in the frequency domain: Introduction to the Fourier transform and the frequency domain, Smoothing frequency domain filters, Sharpening frequency domain filters, homomorphic filtering.

UNIT-III

15 hrs

Image restoration: A model of the image degradation/restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, Periodic noise reduction by frequency domain filtering.

Morphological image processing: Preliminaries, Dilation and erosion, Opening and closing, the hit-or-miss transformation, Some basic morphological algorithms.

UNIT-IV

15 hrs

Image segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region-based segmentation, Segmentation by morphological watersheds.

Representation and description: Representation, Boundary descriptors, Regional descriptors, Use of principal components for description, Relational descriptors.

Reference Books

1. Rafael C. Gonzalez and Richard E. Woods (2008), *Digital Image Processing*, 3rd Edition, Pearson Education.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle (2014), *Image Processing, Analysis and Machine Vision*, 4th edition, Cengage Learning.
3. Anil K. Jain (1997), *Fundamentals of Digital Image Processing*, Prentice-Hall of India Pvt. Ltd.
4. Richard O. Duda, Peter E. Hart, David G. Stork (2008), *Pattern Classification*, 2nd Edition, John Wiley & sons.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

Advanced Data Structures and Algorithms			
Semester:	II	Internal Assessment	40
Course Code:	PCACL21200	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2.00
Credits: 4			

PREREQUISITE(S)

- The students should hold fundamental knowledge of Computers.
- The students should hold the skill set of basic Mathematics.

COURSE OUTCOMES

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

CO-1: Describe representation and functions of arrays. (Level 2: Understand)

CO-2: Analyze an algorithm for searching and sorting techniques in terms of time complexity (Level 4: Analyze)

CO-3: Use stacks, linear lists and queues. (Level 3: Apply)

CO-4: Describe the mathematical model for tree and graphs. (Level 4: Analyze)

CO-5: Demonstrate the data structure concepts using 'C' programming. (Level 3: Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	--	1	--	1	1	3	--
CO2	3	2	2	--	1	--	1	2	2	--
CO3	3	2	2	--	2	--	3	1	2	--
CO4	3	3	2	--	3	--	1	2	2	--
CO5	3	3	3	--	1	2	2	1	3	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Hashing – General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing.

Priority Queues (Heaps) – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations. Binomial Queues: Binomial Queue Structure, Binomial Queue Operations, Implementation of Binomial Queue, Priority Queues in the Standard Library.

UNIT-II**15 hrs**

Trees – AVL: Single Rotation, Double Rotation, B-Trees. Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree. Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion.

Disjoint Sets – Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm.

UNIT-III**15 hrs**

Graphs Algorithms – Elementary Graph Algorithms: Topological sort, Single Source Shortest Path Algorithms: Bellman-Ford, All-Pairs Shortest Paths: Johnson's Algorithm

String Matching – The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

Reference Books

1. Seymour Lipchutz (1986), *Theory and Problems of Data Structures*, Tata Mc Grew.
2. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein (2005), *Data structure using C and C++*, II Edition, PHI Publications.
3. Jean – Paul Tembley and Paul G. Sorenson (1983) *An Introduction to Data Structures with Applications*, II Edition, Tata Mc Graw Hill.
4. Srivastava S K (2011), *Data Structures Through C*, IInd Edition, BPB.
Reema Thareja (2015), *Introduction to C Programming*, IInd Edition, Oxford publication.
5. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

Artificial Intelligence			
Semester:	II	Internal Assessment	40
Course Code:	PCACL21201	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2. 00
Credits: 4			

PREREQUISITE(S)

- Students should have Basic knowledge of Statistics and modeling.
- Students should have knowledge of computers and programming.
- Students should have Analytical skills.

COURSE OUTCOMES

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

CO-1 Explain the fundamentals of Artificial Intelligence. (Level 2 Understand)

CO-2 Explain the Uninformed Searching and informed searching algorithms. (Level 2 Understand)

CO-3 Describe Knowledge representation. (Level 2 Understand)

CO-4 Solve the Gaming problems. (Level 4 Analyze)

CO-5 Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.(Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Artificial Intelligence: History of Artificial Intelligence, Intelligent Agents: Agents and Environments, Rationality, nature of the environment, the structure of Agents.

Problem-solving: Problem-solving agents, Example problems, Searching for solutions,

Uninformed Search Strategies: Breadth-first Search, Uniform cost search, Depth-first search, Depth limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed Search strategies,

UNIT-II

15 hrs

Informed search strategies: Greedy best-first search, A* Search, AO* Search, Heuristic Function

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems

Knowledge, reasoning: Knowledge-based Agents, The Wumpus World, Logic, Propositional Logic, propositional Theorem Proving, Effective Propositional Model checking, agents based on Propositional logic.

UNIT-III

15 hrs

First Order Logic: Representation, Syntax and semantics of FOL, Using First order Logic, Knowledge Engineering in first-order logic.

Inference in First-Order Logic : Propositional vs. First-Order Inference and Lifting, Forward Chaining, Backward Chaining, Resolution .

Expert systems: Introduction, basic concepts, structure of expert systems

Reference Books

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
4. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

Mobile Application Development			
Semester:	II	Internal Assessment	40
Course Code:	PCACL21202	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	4:0:2	Exam Duration (Hours)	2. 00
Credits: 4			

PREREQUISITE(S)

- Students should have basic knowledge of programming

COURSE OUTCOMES

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

CO-1: Describe the basics of Android programming. (Level 2: Understand)

CO-2: Identify Hardware tools and software tools. (Level 2: Understand)

CO-3: Discuss the procedure for Installing and configuring support tools.
(Level 2: Understand)

CO-4: Explain the project structure for the android app. (Level 2: Understand)

CO-5: Apply user interface for app development (Level 3: Apply)

Mapping of Course Outcomes (COs) with Program Learning Outcomes (PLOs)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010
C01	3	3	3	3	2	2	1	1	2	2
C02	3	2	2	3	2	2	2	2	3	3
C03	3	3	3	2	2	2	1	3	3	3
C04	3	2	2	3	1	1	1	2	2	2
C05	3	3	3	2	2	2	1	3	3	3

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Android, Create Your First Android App, Layouts, Views and Resources, Text and Scrolling Views, Build your first app, Activities, Testing, debugging and using support libraries. Understanding Activities and Intents, The Activity Lifecycle and ManagingState Activities and Implicit Intents.

The Android Studio Debugger, Testing your App, The Android Support Library, User Input Controls, Menus, Screen Navigation, Recycler View

UNIT-II

15 hrs

Drawables, Styles and Themes, Material Design, Providing Resources for Adaptive Layouts, Testing the User Interface, Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, Transferring Data Efficiently

UNIT-III

15 hrs

ANDROID APIs Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Reference Books

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. <https://www.gitbook.com/book/googledeveloper-training/android-developer-fundamentals-course-concepts/details> (Download pdf file from the above link)
2. Michael Burton, Android App Development For Dummies 3rd Edition, Kindle Edition
3. John Horton, Android Programming for Beginners, Packet

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER-II

OOP's using Java			
Semester:	II	Internal Assessment	40
Course Code:	PCACL21203	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	4:0:2	Exam Duration (Hours)	2. 00
Credits: 4			

PREREQUISITE(S)

- Students should have the knowledge of procedure oriented programming.

COURSE OUTCOMES

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

- CO-1: Distinguish between object oriented paradigm and the procedure oriented paradigm.. (Level 2 Understand)
- CO-2: Explain the basic principles of object-oriented design. (Level 2 Understand)
- CO-3: Write Java application programs using OOP principles and proper program structuring. (Level 3 Apply)
- CO-4: Create packages and interfaces. (Level 6 Create)
- CO-5: Apply practical experience gained in designing and constructing data models using java programming. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010
CO1	3	2	3	3	1	1	2	2	2	1
CO2	3	1	3	2	1	1	2	1	2	2
CO3	3	3	2	3	1	1	2	2	2	1
CO4	3	2	2	2	2	3	3	3	2	2
CO5	3	2	2	3	1	3	2	3	3	3

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Java: Importance and features of java, keywords, constants, variables and data types,

Operators and expressions, Decision making, branching and looping: if..else, switch, ?: operator, while, do, for statements, labeled loops, jump statements: break, continue, return.

Classes and Objects: defining a class, adding variables and methods, creating objects, constructors, class inheritance.

Arrays and Strings: creating an array, one and two dimensional arrays, string array and methods, String and StringBuffer classes, Wrapper classes.

UNIT-II

15 hrs

Inheritance: Basics types, using super, Multilevel hierarchy abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

Exception Handling: Fundamentals, exception types, uncaught exceptions, throw, final, built in exception, creating your own exceptions.

Multithreaded Programming: Fundamentals of Java thread model, priorities, synchronization, messaging, thread class, Runnable interface, interthread Communication, suspending, resuming and stopping threads.

UNIT-III

15 hrs

Input/Output: Basics, Streams, Byte and Character stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (lang, util, io, net).

Event Handling: Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes, working with windows, graphics and text, using AWT controls, Layout managers and menus, handling Image, animation, sound and video, Java Applet.

JDBC: JDBC API, JDBC Drivers, Products, JDBC Design considerations, Basic steps to JDBC, setting up a connection to database, Creating and executing SQL statements.

Reference Books

1. E. Balaguruswamy, *Programming with Java*, A primer, 4th Edition, Tata McGraw-Hill Publications.
2. Herbet Schildt, *The Complete Reference Java* Seventh Edition, MCGrawHill.
3. Paul Deital & Harvey Deital (2015), *Java: How to Program*, 10th Edition, Pearson Education.
4. Robert Lafore (2002), *Object Oriented Programming in C++*, 4th Edition, Galgotia publications.
5. Herbert Schildt (2002), *JavaTM2 the Complete Reference*, 5th Edition, Tata McGraw-Hill.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- II

Information Retrieval Systems			
Semester:	II	Internal Assessment	40
Course Code:	PCACL21204	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2: 00
Credits: 4			

PREREQUISITE(S)

- Students must have the minimal concept of Data Base Management Systems
- They must also have the concept of different types of algorithms used for searching data
- They must also have the minimal knowledge of Natural language such as thesaurus, synonyms etc. to understand the concept of retrieving the textual information because text is the main data type used in Information Retrieval Systems

COURSE OUTCOMES

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

CO1: Understanding the basics of Information Retrieval

CO2: Learn the different techniques for compression of an index including the dictionary and its posting list.

CO3: Developing the ability of develop a complete IR system from Scratch.

CO4: Understanding the data structures like Inverted Indices used in Information retrieval systems.

CO5: Understanding the different techniques for compression of an index including the dictionary and its posting list.

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses. Information Retrieval System Capabilities: Search, Browse, Miscellaneous

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.

UNIT-II

15 hrs

Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext. Information Visualization: Introduction, Cognition and perception, Information visualization technologies. Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example –TREC results.

Reference Books

1. David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition(Distributed by Universal Press), 2004.
2. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.
3. Soumen Chakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
4. Christopher D Manning, Prabhakar Raghavan, Hinrich Schütze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009.
5. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
6. 2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
7. Yates, Modern Information Retrieval, Pearson Education, 1999.
8. Robert Korfhage, Information Storage & Retrieval, John Wiley & Sons, 1997.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- II

Introduction to Artificial Intelligence			
Semester:	II	Internal Assessment	30
Course Code:	PCATG21200	End Sem. Exam	45
Teaching Hours/Week (L:T:P):	3:0:0	Exam Duration (Hours)	2
Credits: 3			

PREREQUISITE(S)

- Students should have Basic knowledge of Statistics and modeling.
- Students should have knowledge of computers and programming.
- Students should have Analytical skills.

COURSE OUTCOMES

After completing this course, the students should be able to:

CO-1 Explain the fundamentals of Artificial Intelligence. (Level 2 Understand)

CO-2 Explain the Uninformed Searching and informed searching algorithms. (Level 2 Understand)

CO-3 Describe Knowledge representation. (Level 2 Understand)

CO-4 Solve the Gaming problems. (Level 4 Analyze)

CO-5 Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.(Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Artificial Intelligence: History of Artificial Intelligence, What is AI, Intelligent Agents: Agents and Environments, Rationality, nature of the environment, the structure of Agents. Problem-solving: Problem-solving agents, Example problems, Searching for solutions,

UNIT-II

15 hrs

Uninformed Search Strategies: Breadth-first Search, Uniform cost search, Depth-first search, Depth limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed Search strategies, **Informed search strategies:** Greedy best-first search, A* Search, Heuristic Function

UNIT-III

15 hrs

Knowledge, reasoning: Knowledge-based Agents, The Wumpus World, Propositional Logic, agents based on Propositional logic.

First Order Logic: Representation, Syntax and semantics of FOL, Knowledge Engineering in first-order logic.

Text Books

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

Reference Books

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices", 7th Edition, Pearson Education, 2016, ISBN 978-93-325-5508-2.
2. Thomas L. Floyd, "Electronic Devices" Pearson Education, 9th Edition, 2012.
3. D.P. Kothari, I.J. Nagarath, "Basic Electronics," 2nd Edn. McGraw Hill, 2018.
4. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices," 3rd Edition, Wiley, 2018.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- II

Introduction to Python			
Semester:	II	Internal Assessment	30
Course Code:	PCATG21201	End Sem. Exam	45
Teaching Hours/Week (L:T:P):	3:0:0	Exam Duration (Hours)	1
Credits: 3			

PREREQUISITE(S)

- Students should have knowledge of computers and programming

COURSE OUTCOMES

- Student will able to
- CO-1 Explain the fundamentals of python programming. (Level 2 Understand)
- CO-2 Explain the basic principles of functions and modules. (Level 2 Understand)
- CO-3 Describe file handling and exception handling. (Level 2 Understand)
- CO-4 Identify and fix common errors in Python programs. (Level 4 Analyze)
- CO-5 Write codes in Python to solve mathematical or real world problems. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Python Language: History of Python, What is Python mainly used for?, Strengths and Weaknesses, IDLE, Dynamic Types, Naming Conventions.

The Context of Software Development: Software, Learning Programming with Python. Values and Variables-Integer and String Values-Identifiers-User Input-String Formatting, String Values, String Operations, String Slices, String Operators.

UNIT-II

15 hrs

Data Collections and Language Component: Numeric Data Types, Conversions, Built-in Functions, Expressions and Arithmetic- Expressions, Arithmetic Examples.

Control Flow and Syntax: Indenting, if Statement, If Else Statement, elif Statement, For Loops While Loops, While True Loops.

UNIT-III

15 hrs

Functions and Modules: Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function.

Objects and Classes: Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods.

Reference Books

1. Charles Dierbach (2015), *Introduction to Computer Science using Python*, Wiley, 1st Edition ISBN-10: 81265560132015
2. John Zelle (2010), *Python Programming: An Introduction to Computer Science*, 2nd Edition.
3. Zed A. Shaw (2017), *Learn Python the Hard Way* Paperback, Pearson Education, 3rd Edition ISBN-10: 9332582106.
4. Felix Alvaro, *PYTHON*, Easy Python Programming for Beginners, Your Step-By-Step Guide to Learning Python Programming.
5. Paul Barry (2010), *Head First Python*, O' Reilly Publishers, 1st Edition, ISBN: 1449382673.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Theory of Computation			
Semester:	III	Internal Assessment	50
Course Code:	PCACC31300	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	4:0:2	Exam Duration (Hours)	2. 30
Credits: 5			

PREREQUISITE(S)

- The students should hold knowledge of general computing and set theory.

COURSE OUTCOMES

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

CO-1: Explain the concept of Automata theory and Turing machine. (Level 2: Understand)

CO-2: Apply regular expression on real time problem. (Level 3: Apply)

CO-3: Use Context-Free Grammars for the real time requirements. (Level 3: Apply)

CO-4: Discuss on Normal forms. (Level 2: Understand)

CO-5: Describe recursive enumerable approach for the real time problems. (Level 4: Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	1	--	--	3	1	1	2
CO2	3	3	2	1	--	--	2	--	2	--
CO3	3	3	3	--	--	--	3	1	2	--
CO4	2	2	2	--	--	--	1	--	2	--
CO5	2	1	2	--	--	--	2	--	2	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Finite Automata: Introduction to Finite Automata, the central concepts of Automata theory, deterministic finite automata, non-deterministic finite automata, equivalence NFA and DFA, Finite automata with Epsilon-transitions, conversion NFA with Epsilon-transitions to NFA, minimization of finite automata, finite automata with output, Moore and Melay machine.

UNIT-II

15 hrs

Regular Expressions and Languages: Regular expression, equivalence Finite Automata and Regular Expressions, Closure properties of Regular languages, pumping lemma: proving languages not to be regular.

UNIT-III

15 hrs

Context-Free Grammars and Languages: Type of grammar, Chomsky's hierarchy, derivation and its types, parsing, Parse trees, Ambiguity in grammars and removal techniques. Simplification of CFG: elimination of useless symbol, elimination of useless production, elimination of null production and unit production. Properties of Context-Free Languages: Normal forms for CFG: CNF and GNF, The pumping lemma for CFLs, Closure properties of CFLs. Regular grammar, conversion right linear to left linear and left linear to right linear regular grammar, equivalence of regular grammar and finite automata.

UNIT-IV

15 hrs

Pushdown Automata: Definition of the Pushdown automata, the languages of a PDA, Instantaneous description, criteria of acceptance of the PDA, Equivalence of PDA's and CFG's, Non-deterministic Pushdown Automata. Introduction to Turing Machines: Turing machine model, design of Turing machine as input output device, to compute function, language acceptor, problems that computer cannot solve, programming techniques for Turing Machines, extensions to the basic Turing Machine, restricted Turing Machines.

Reference Books

1. J.P. Hopcroft, Rajeev Motwani, J.D. Ullman (2001), Introduction to automata Theory, Languages and Computation, 2nd edition, Pearson Education.
2. Kamala Kirtivasan, Rama R (2009), Introduction to Formal Languages, Automata Theory and Computation, Pearson
3. H.R. Lewis, Shistor H, Papadimitroce (1999), Elements of theory of Computation, PHI
4. John Mastin (1998), Introduction to Language and Theory of Computation, TMH.
5. Rajesh K Shukla, Cengage (2009), Theory of Computation, Delmar Learning India Pvt. Ltd

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Wireless Network and Mobile Computing			
Semester:	III	Internal Assessment	50
Course Code:	PCACC31303	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2:30
Credits: 5			

PREREQUISITE(S)

- The students should hold knowledge of general computing, Combinetrics and set theory.

COURSE OUTCOMES

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

CO-1: Understand the fundamental concepts of computer networks and communication models.

CO-2: Apply data communication protocols and techniques to analyze network operations.

CO-3 Evaluate wireless technologies and standards used in modern communication systems.

CO-4: Understand the architecture, protocols, and security concerns in mobile computing environments.

CO-5: Design basic applications using mobile computing concepts for real-time communication.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	--	--	3	3
CO4	3	2	2	--	1	1	1	2	2	2
CO5	3	3	3	2	2	--	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Computer Networks: LAN, MAN, WAN, PAN, OSI and TCP/IP Models. Transmission Media (wired/wireless), Switching Techniques: Circuit, Packet, and Message Switching, IP Addressing and Subnet, Routing Algorithms: Distance Vector, Link State

UNIT-II

15 hrs

Data Transmission: Analog & Digital, Bandwidth, Data Rate, Error Detection and Correction Techniques (CRC, Hamming Code), MAC Protocols: CSMA/CD, CSMA/CA, Transport Layer Protocols: TCP, UDP, Application Layer Protocols: HTTP, FTP, SMTP, DNS

UNIT-III

15 hrs

Introduction to Wireless Communication, Wireless Transmission: Frequencies, Antennas, Multiplexing. Wi-Fi (IEEE 802.11), Bluetooth, Zigbee, Cellular Networks: GSM, GPRS, 3G, 4G, LTE, Wireless Sensor Networks: Architecture, Protocols, Security Issues in Wireless Networks Concepts and Challenges in Mobile Computing: Mobile IP and Mobile TCP, Wireless Application Protocol (WAP), Android Architecture and Mobile App Development Basics, Location-based Services and Context-aware Computing, Mobile Device Management and Security

Security in Mobile And IoT: Security, Threats To SDN, NFV Security Attack Surfaces, ETSI Perspective,

UNIT-IV

15 hrs

Cloud Security, Security Issues, Risks, Data Protection, Security As A Service, Addressing Cloud Security, IoT Security, Vulnerability Patching, Requirements By ITU-T, Security Framework.

Reference Books

1. J. Schiller, "Mobile Communications", Addison Wesley.
2. Charles Perkins, "Mobile IP", Addison Wesley.
3. Upadhyaya, "Mobile Computing", Springer New York
4. Behrouz A Forouzan, Cryptography and Network Security , McGraw-Hill Education, 2011
5. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall India, 4th Edition
6. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" William Stallings Publisher: Addison-Wesley 2015
7. William Stallings, Cryptography and Network Security: Principles and Standards, Prentice Hall India, 3rd Edition, 2003

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Advanced Software Engineering			
Semester:	III	Internal Assessment	50
Course Code:	PCACC31303	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- Fundamentals of Software Engineering
- Basics of Java Programming or general programming

COURSE OUTCOMES

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

CO-1 To understand the basics of testing and its features (Level 1 Remember)

CO-2 To demonstrate the implementation of white box and black box testing (Level 4 Analyze)

CO-3 To Describe the different types of testing and its importance in testing the real time product (Level 2 Understand)

CO-4 To define the regression testing and its benefits (Level 2 Understand)

CO-5 To Apply mind for designing and constructing automation testing to the real time product using Tools. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	--	--	3	3
CO4	3	2	2	--	1	1	1	2	2	2
CO5	3	3	3	2	2	--	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

The Product and The Process: Evolving role of software, software characteristics and components,

Crisis, Software Myths, Software Engineering-A Layered Technology, Software process, linear sequential model, Prototyping model, RAD model, Evolutionary software process model, Analysis **Concepts and**

UNIT-II

15 hrs

Principles: Requirement analysis, communication techniques, analysis principles, software prototyping and specification.

Object-Oriented Software Engineering, object-oriented paradigm, object modelling languages, object-oriented analysis, object-oriented design, object-oriented programming, object-oriented metrics, object-oriented case tools, object-oriented software testing

UNIT-III

15 hrs

Project Management: Introduction, Process and Product, Scheduling and tracking Management activities, Software Process and its Problems in all Phases, Problems with Software Production, IEEE Standard for Software project management plan, CASE tools, CBSE, Reengineering, forward engineering.

UNIT-IV

15 hrs

Software Cost Estimation: Productivity, Estimation Techniques, Algorithmic Cost Modelling, Project Duration and Staffing, Quality Management: Quality Assurance and Standards, Quality Planning, Quality Control,

Verification and Validation (V & V): Static and Dynamic V & V, V & V Goals, V & V vs. Debugging, Software Inspections / Reviews, Clean-Room Software Development; Software Testing: Defect Testing, Integration Testing, Interface Testing, Object-Oriented Testing, Testing Workbenches.

Reference Books

1. Pressman Roger S., Software Engineering: Practitioner's Approach, McGraw-Hill Inc., 2004.
2. Ian Sommerville, Software Engineering, Pearson Education, 2009.
3. N. S. Gill, Software Engineering: Software Reliability, Testing and Quality Assurance, Khanna Book Publishing Co (P) Ltd., New Delhi, 2002.
4. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, New Delhi 1997
5. J. Rumbaugh, M. Blaha, W. Premerlani, Object-Oriented Modeling and Design, PHI, 1991.

 <small>CENTRAL UNIVERSITY OF KARNATAKA</small>	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009)</p> <p style="text-align: center;">School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Cloud Computing			
Semester:	III	Internal Assessment	50
Course Code:	PCACL31300	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- The students should know the basic knowledge of Big Data concepts.
- The students should know the basic knowledge of Cloud computing concepts.

COURSE OUTCOMES

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

CO-1: Explain BigData Challenges and its working protocol. (Level 2: Understand)

CO-2: Discuss on analytical architecture. (Level 2: Understand)

CO- 3: Explain cloud computing, virtualization and classify services of cloud computing. (Level 3: Apply)

CO- 4: Illustrate architecture and programming in cloud. (Level 3: Apply)

CO- 5: Describe the platforms for development of cloud applications and List the application of cloud. (Level 3: Apply)

Mapping of Course Outcomes (COs) with Program learning Outcomes (PLOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Opensource software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud

computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model:

UNIT-II

15 hrs

The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, Highperformance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

UNIT-III

15 hrs

Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a twolevel resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

UNIT-IV

15 hrs

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

Reference Books

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education
2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.
3. Cloud Computing: Theory and Practice, Dan C Marinescu Elsevier (MK), 2013.
4. Computing Principles and Paradigms, RajkumarBuyya , James Broberg, Andrzej Goscinsk,i Willey, 2014.
5. Cloud Computing Implementation, Management and Security John W Rittinghouse, James F Ransome, CRC Press, 2013.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Natural Language Processing			
Semester:	III	Internal Assessment	50
Course Code:	PCACL31301	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- The Students should have knowledge of theoretical computer Science.
- Students should be aware of neural network and machine learning.

COURSE OUTCOMES

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

- CO-1. Define the regular expression and Automata. (Level 1 Remember)
- CO-2. Demonstrate the text to speech model. (Level 3 Apply)
- CO-3. Explain the word classes and part-of speech tagging. (Level 2 Understand)
- CO-4. Apply the information retrieval model on given sample. (Level 3 Apply)
- CO-5. Use of machine translation on natural language processing. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (Pos)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	1	1	2	2
CO2	2	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction: Natural Language Processing, Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications. Language Modeling: Statistical Language Model - N-gram model (unigram, bigram), Paninon Framework, Karaka theory.

UNIT-II

15 hrs

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error

Detection and Correction, Words and Word Classes, Part-of Speech Tagging.

Syntactic Analysis: Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing.

UNIT-III

15 hrs

Naive Bayes, Text Classification and Sentiment: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model.

Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval.

UNIT-IV

15 hrs

Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.

Machine Translation: Language Divergences and Typology, Machine Translation using EncoderDecoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.

Reference Books

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press.
2. Daniel Jurafsky, James H. Martin, "Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2023.
3. Akshay Kulkarni, Adarsha Shivananda, "Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python", Apress, 2019.
4. T V Geetha, "Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", Pearson, 2024.
5. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer Academic Publishers.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Modeling and Simulation			
Semester:	III	Internal Assessment	50
Course Code:	PCACL31302	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- The students should hold basic knowledge of Computers.
- The students should hold the skill set of basic Mathematics

COURSE OUTCOMES

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

- CO-1: Describe the role of important elements of discrete event simulation and modeling paradigm.
- CO-2: Conceptualize real-world situations related to systems development decisions originating from source requirements and goals.
- CO-3: Develop skills to apply simulation software to construct and execute goal-driven system models.
- CO-4: Interpret the model and apply the results to resolve critical issues in a real-world environment.
- CO-5: Apply the simulation to solve problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

System Models: The concept of a system, system environment, stochastic activities, continuous and discrete systems, system modeling, types of models, static physical model, dynamic physical model, static mathematical models, dynamic mathematical model, and principles used in modeling. Introduction to **Simulation:** Simulation of a pure-pursuit problem-an example, a system and its model, simulation of an inventory problem, the basic nature of simulation, when to simulate.

UNIT-II

15 hrs

Simulation of Continuous Systems: A chemical reactor, simulation of a servo system, simulation of a water reservoir system, analog vs. digital simulation. Discrete System Simulation: Fixed time-step vs. event-to-

event model, on simulating randomness, generation of random nos., generation of non-uniformly distributed random nos., Monte-Carlo computation vs. stochastic simulation.

UNIT-III

15 hrs

Simulation of queuing Systems: Simulation of a single-server queue, simulation of a two-server queue, simulation of more general queues. **Inventory Control and Forecasting:** Elements of inventory theory, more complex inventory models, simulation example-1, simulation example-2, and forecasting and regression analysis

UNIT-IV

15 hrs

Design and Evaluation of Simulation Experiments: Length of simulation runs, variance reduction techniques, validation.

Reference Books

1. System Simulation with Digital Computer, N. Deo, PHI.
2. System Simulation, G. Gordon, PHI.
3. Discrete Event system simulation, Banks J Crson & Nelson, PHI, India 1996
4. Element of stochastic Press & Simulation, Gottfried PHI, London, 1984
5. System Simulation with Digital Computer Narsingh Deo, PHI.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Fuzzy Sets and Fuzzy Logic			
Semester:	III	Internal Assessment	50
Course Code:	PCACL31303	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

COURSE OUTCOMES

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

- CO-1. Explain the difference between crisp set and fuzzy set theory. (Level 2 Understand)
- CO-2. Analyze statistical data by using fuzzy logic methods. (Level 4 Analyze)
- CO-3. Discuss applications of Fuzzy logic membership function and fuzzy inference systems. (Level 2 Understand)
- CO-4. Compare statistical methods against fuzzy logic methods. (Level 4 Analyze)
- CO-5. Describe the fuzzy statistics applications. (Level 2 Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction: Crisp Sets An Overview, Basic Types, Basic Concepts Characteristics and Significance of the Paradigm Shift.

Fuzzy Sets Versus Crisp Sets: Additional Properties of α -Cuts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets.

UNIT-II

15 hrs

Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersections t-norms, fuzzy unions i-conorms, combinations of operations, aggregation operations.

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals Arithmetic Operations on Fuzzy Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations

UNIT-III

15 hrs

Fuzzy Relations: crisp versus fuzzy relations, projections and cylinder extensions, binary fuzzy relations, binary relations on a single set, fuzzy equivalence relations, fuzzy compatibility relations, fuzzy ordering relations.

Fuzzy Relation Equations: General discussion, problem partitioning, solution method, fuzzy relation equations based on sup-i compositions, fuzzy relation equations based on in-fwi compositions, approximate solutions, the use of neural networks.

UNIT-IV

15 hrs

Fuzzy logic: Classical, multi valued logic's, fuzzy propositions, fuzzy quantifiers, linguistic hedges, inference from conditional fuzzy propositions, inference from conditional and qualified propositions, information and uncertainty, non specificity of crisp sets, non specificity of fuzzy sets, fuzziness of fuzzy sets, uncertainty in evidence theory, summary of uncertainty measures, principles of uncertainty.

Reference Books

1. George J. Klir and Bo Yuan (1995), *Fuzzy sets and fuzzy logic: theory and applications*, first edition, Prentice hall.
2. David A. Coley (1999), *An Introduction to Genetic Algorithms for Scientists and Engineers*, World Scientific

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Pattern Recognition			
Semester:	III	Internal Assessment	50
Course Code:	PCACL31304	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer graphics.

COURSE OUTCOMES

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

- CO-1. Explain the application of pattern recognition. (Level 2 Understand)
- CO-2. Discuss the estimation of parameters from samples and minimum risk estimators. (Level Understand)
- CO-3. Calculate the unequal costs of error and estimation of error rates. (Level 4 Analyze)
- CO-4. Use of clustering techniques on given samples. (Level 3 Apply)
- CO-5. Develop the neural network model for pattern recognition (Level 6 Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction Pattern recognition and learning (supervised, unsupervised), training and test sets, feature selection, Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques.

Classification Univariate and multivariate density, discriminant functions for the normal Density different

cases,

UNIT-II

15 hrs

Bayes decision theory – discrete features, compound Bayesian decision theory and context, Minimum-error rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features

Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case

UNIT-III

15 hrs

Clustering Different distance functions and similarity measures, Criterion for clustering, Methods of clustering - partitional, hierarchical, graph theoretic, density based., Cluster validity

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Data description and clustering – similarity measures, criteria function for clustering

UNIT-IV

15 hrs

Artificial Neural Networks: Introduction, nets without hidden layers. nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application.

Processing of Wave-forms and Images: Introduction, gray level scaling transformations, equalization, geometric image and interpolation, Smoothing, transformations, edge detection, Laplacian and sharpening operators, line detection and template matching.

Reference Books

1. Eart Gose, Richard Johnsonburg and Steve Joust (2003), *Pattern Recognition and Image Analysis*, Prentice Hall, India.
2. Robert J Schalkoff, John (2007), *Pattern recognition: Statistical, Structural and neural approaches*, Wiley.
3. Earl Gose, Richard Johnsonbaugh, Steve Jost (2009), *Pattern Recognition and Image Analysis*, 1st Edition, PHI.
4. Pankaj Sharma,(2008), *Artificial Intelligence*, S K Kataria & Sons
5. Pattern Recognition: An Algorithmic Approach, By M. Narasimha Murty and V. Susheela Devi, Springer; 2011 edition
6. Fundamentals of Pattern Recognition and Machine Learning, By Braga-Neto, Springer International Publishing, 2020
7. Pattern Recognition, By S. Theodoridis and K. Koutroumbas, 4th Ed., Academic Press, 2009

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Software Testing			
Semester:	III	Internal Assessment	50
Course Code:	PCACL31305	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- Fundamentals of Software Engineering
- Basics of Java Programming or general programming

COURSE OUTCOMES

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

CO-1: To understand the basics of testing and its features (Level 1 Remember

CO-2: To demonstrate the implementation of white box and black box testing (Level 4 Analyze)

CO-3: To Describe the different types of testing and its importance in testing the real time product (Level 2 Understand)

CO-4: To define the regression testing and its benefits (Level 2 Understand)

CO-5: To apply mind for designing and constructing automation testing to the real time product using Tools. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1	1	1	1	1	1	1
CO2	3	2	3	2	2	2	2	1	1	1
CO3	3	2	2	2	1	2	2	1	1	1
CO4	2	1	2	1	2	2	1	2	1	1
CO5	2	3	1	3	1	2	1	1	2	2

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction: Error and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software defect tracking.

UNIT-II

15 hrs

Test case Design Methods: White box testing, static testing, static analysis tools, Structural testing: Unit/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing, Boundary value analysis, Equivalence partitioning, Model based testing and model checking, Differences between white box and Black box testing

UNIT-III

15 hrs

System, Integration and Acceptance Testing : Top down and Bottom up integration, Bi-directional integration, System integration, Scenario Testing, Functional versus Non-functional testing, Design/Architecture verification, Deployment testing, Beta testing, Scalability testing, Stress testing, Acceptance testing: Acceptance criteria, test cases selection and execution.

UNIT-IV

15 hrs

Regression test process, Selection of regression tests, Execution Trace, Dynamic Slicing, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding. **Automation Test:** Test Planning, Execution and Reporting, Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems.

Reference Books

1. S. Desikan and G. Ramesh, “Software Testing: Principles and Practices”, Pearson Education.
2. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.
3. Naik and Tripathy, “Software Testing and Quality Assurance”, Wiley
4. K. K. Aggarwal and Yogesh Singh, “Software Engineering”, New Age International Publication

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- III

Mini Project			
Semester:	III	Internal Assessment	20
Course Code:	PCAPC31400	End Sem. Exam	30
Teaching Hours/Week (L:T:P):	0:0:4	Exam Duration (Hours)	2: 00
Credits: 2			

PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering

Mini Project

Project work will be carried out either in the department. Each student shall carry out the project work individually/group (Max two members) and present the work done in the seminar conducted in the department. The students are required to submit a soft copy of the project report based on the work done by him/her during the project period. The project topics should be approved from the departmental panel. Students must submit a synopsis separately of more than one topic.

Synopsis Template

The write up must adhere to the guidelines and should include the following:

- 1 Name / Title of the Project
- 2 Objective and scope of the Project
- 3 Introduction and Review
- 4 Applications
- 5 Conclusions
- 6 Requirements (Hardware and Software)

Guidelines for preparing the project Report:

A4 size page should be used for typing, Left margin: 3.0cm Right margin: 2.0 cm, Top margin: 2.54 cm, Bottom margin: 2.54 cm, All pages as well as should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above, and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size:10, Courier New, Normal

Submission of Project Report

Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Machine Learning			
Semester:	IV	Internal Assessment	50
Course Code:	PCACC41500	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2:30
Credits: 5			

PREREQUISITE(S)

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

COURSE OUTCOMES

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

CO-1. Describe the different forms of learning (Level 1 Remember)

CO-2. Use the provability theory in machine learning. (Level 3 Apply)

CO-3. Examine the classification techniques on given datasets. (Level 4 Analyze)

CO-4. Construct neural network model for machine learning. (Level 6 Create)

CO-5. Design clustering algorithms to classify given sample in machine learning. (Level 6 Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Machine Learning, Applications of Machine Learning, processes involved in Machine Learning, Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.

Data sets and Attribute types, Basic statistical descriptions of Data, Data Visualization, Measuring Data similarity and Dissimilarity.

UNIT-II

15 hrs

Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data discretization. Feature sets, Dataset division: test, train and validation sets, cross validation.

Frequent pattern mining and association Rules: Apriori, FP Growth algorithms

UNIT-III

15 hrs

Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Decision trees, Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve.

UNIT-IV

15 hrs

Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering.

List of Experiments

1. Mathematical computing with Python packages like: numpy, Mat- plotLib, pandas, Tensor Flow, Keras.
2. Data processing using Python packages.
3. Implement basic ML models like Decision trees, SVM, KNN, K-Means, Logistic Regression, and Linear Regression.

Reference Books

1. Introduction to Machine Learning, By Jeeva Jose, Khanna Book Publishing Co., 2020.
2. Machine Learning for Dummies, By John Paul Mueller and Luca Massaron, For Dummies, 2016.
3. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.
4. Machine Learning: The New AI, By Ethem Alpaydin, The MIT Press, 2016.
5. Data mining Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, M K Publishers.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Big Data Analytics			
Semester:	IV	Internal Assessment	50
Course Code:	PCACL41500	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- Learn Fundamentals of DBMS
- Cover the data analysis with examples.

COURSE OUTCOMES

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

CO1: Understand the basics of Fundamentals of Big Data

CO2: To implement Map Reduce programs for processing big data.

CO3: To realize storage and processing of big data using MongoDB, Pig, Hive and Spark.

CO4: To analyze big data using machine learning techniques.

CO5: To learn the HADOOP Technology

Mapping of Course Outcomes (COs) with Program learning Outcomes (PLOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Big Data: Big data features and challenges, Problems with Traditional Large-Scale System , Sources of Big Data, 3 V's of Big Data, Types of Data. Working with Big Data: Google File System. Hadoop Distributed File System (HDFS)-Building blocks of Hadoop (Namenode. Data node. Secondary Namenode. Job Tracker. Task Tracker), Introducing and Configuring Hadoop cluster (Local. Pseudo distributed mode, Fully Distributed mode). Configuring XML files.

UNIT-II

15 hrs

Writing Map Reduce Programs: A Weather Dataset. Understanding Hadoop API for MapReduce Framework (Old and New). Basic programs of Hadoop MapReduce: Driver code. Mapper code, Reducer code. Record Reader, Combiner, Partitioner.

Hadoop I/O: The Writable Interface. Writable Comparable and comparators. Writable Classes: Writable wrappers for Java primitives. Text. Bytes Writable. Null Writable, Object Writable and Generic Writable. Writable collections. Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators.

UNIT-III

15 hrs

Pig: Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow. Working through the ABCs of Pig Latin. Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark.

UNIT-IV

15 hrs

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive. Examining the Hive Clients. Working with Hive Data Types. Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data.

Reference Books

1. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.
3. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
4. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
5. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
6. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

 CENTRAL UNIVERSITY OF KARNATAKA	Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

IoT and Its Applications			
Semester:	IV	Internal Assessment	50
Course Code:	PCACL41501	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- Students must be knowledge of basic electronics and computers
- Students must be knowledge of operating system

COURSE OUTCOMES

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

CO-1: Understand IoT architecture, communication models, and protocols..

CO-2: Identify and interface appropriate sensors and actuators for IoT systems.

CO-3: Apply microcontroller-based programming and design embedded systems for IoT applications..

CO-4: Analyze real-world IoT applications and evaluate implementation challenges.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	2	1	1	2	1	1	1	2	2
CO2	1	3	2	1	3	3	1	2	1	2
CO3	2	2	1	3	2	1	2	1	1	1
CO4	2	3	2	3	1	2	2	1	2	2
CO5	2	1	3	2	2	2	1	2	3	2

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction : IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing

IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack, Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT-II

15 hrs

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Securing IoT, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT-III

15 hrs

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT-IV

15 hrs

IoT Physical Devices and Endpoints: Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors.

Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017
3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
4. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Cyber Security and Block Chain Technology			
Semester:	IV	Internal Assessment	50
Course Code:	PCACL41501	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- The students should hold basic knowledge of programming.
- The students should hold the skill set of basic mathematics.

COURSE OUTCOMES

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

- CO-1: To understand the core concepts of cyber security, threats, and countermeasures
CO-2: To learn cryptographic techniques and security protocols.
CO-3: Illustrate the concepts of Bitcoin and their usage.
CO-4: To explore the fundamentals of blockchain technology and its underlying architecture.
CO-5: Apply security features in blockchain technologies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Cyber Security, Security Goals: Confidentiality, Integrity, Availability, Types of Threats and Attacks: Malware, Phishing, DoS/DDoS, SQL Injection, Cybersecurity Policies and Compliance (ISO 27001, NIST, GDPR), Firewalls, IDS, IPS and Antivirus Systems, Cyber Ethics and Cyber Laws (IT Act 2000 Overview)

UNIT-II

15 hrs

Principles of Cryptography: Symmetric vs Asymmetric, Encryption Algorithms: AES, DES, RSA, Hash Functions: SHA, MD5, Digital Signatures and Certificates, Secure Communication Protocols: SSL/TLS, IPsec, Authentication Mechanisms: Passwords, Biometrics, 2FA, OTP

UNIT-III

15 hrs

Introduction to Blockchain: History, Need, and Definition, Blockchain Architecture: Blocks, Chain, Hashing, and Merkle Trees, Types of Blockchain: Public, Private, Consortium, Consensus Mechanisms: Proof of Work, Proof of Stake, PBFT, Smart Contracts: Definition and Use Cases, Overview of Popular Blockchain Platforms: Bitcoin, Ethereum, HyperledgerBlockchain in Finance: Cryptocurrencies, Digital Wallets, DeFi,

UNIT-IV

15 hrs

Blockchain in Supply Chain, Healthcare, Voting, and Identity Management, Security in Blockchain: 51% Attack, Sybil Attack, Smart Contract Vulnerabilities, Blockchain and IoT Integration, Regulatory Challenges and Legal Framework, Future Trends: Web3, NFTs, Metaverse, Green Blockchain

Reference Books

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrencies – A Comprehensive Introduction”, Princeton University Press.
2. Josh Thompson, ‘Blockchain: The Blockchain for Beginners, Guide to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.
3. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing.
4. Merunas Grincalaitis, “Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”, Packt Publishing.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Deep Learning			
Semester:	IV	Internal Assessment	50
Course Code:	PCACL41502	End Sem. Exam	75
Teaching Hours/Week (L:T:P):	3:1:2	Exam Duration (Hours)	2: 30
Credits: 5			

PREREQUISITE(S)

- The students should hold Strong Knowledge of Mathematics and Statistics.
- The students should have a basic understanding of Programming knowledge.
- The students should have knowledge of how machine learning works.

COURSE OUTCOMES

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

- CO-1: To examine recent trends in data collection and analysis techniques.(Level 2: Understand)
- CO-2: Understand the features of machine learning to apply on real world problems(Level 5: Evaluate)
- CO-3: Analyze the concept of neural networks for learning linear and non-linear activation functions(Level 4: Analyze)
- CO-4: Implement deep learning algorithms and solve real-world problems (Level 3: Apply).
- CO-5: Able to analyze the given dataset for designing a neural network based solution(Level 2: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	--	3	1	2	--
CO2	3	3	2	--	--	--	2	1	1	--
CO3	3	2	2	--	--	--	3	--	2	2
CO4	3	1	2	--	--	--	2	--	1	--
CO5	2	1	2	2	--	1	1	--	--	--

DETAILED SYLLABUS

UNIT-I

15 hrs

Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters

and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

Fundamentals of Neural Networks: Introduction to Neural Network, Model of Artificial Neuron, Learning rules and various activation functions.

UNIT-II

15 hrs

Neural Network Architecture: Single layer Feed-forward networks. Multi-layer Feed-forward networks. Recurrent Networks.

Back propagation Networks: Back Propagation networks, Architecture of Back-propagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation algorithms.

UNIT-III

15 hrs

Deep Neural Networks: Introduction to Deep Neural Networks, training deep models, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, Gradient- Descent Strategies, vanishing and exploding Gradient problems, regularizations, dropouts.

Convolutional Neural Networks: Basic structure of Convolutional Network, the Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features., Convolutions for Images, Padding and Stride, Multiple Input and Multiple Output Channels, FCNN Case study: Image classification using CNN.

UNIT-IV

15 hrs

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition.

Reference Books

1. Goodfellow I., BengioY., and Courville A., "Deep Learning", MIT Press, 2016, ISBN: 978-0262035613.
2. S.Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithms", PHI Learning Pvt. Ltd., 2003, ISBN:978-81-203-2186-1.
3. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, "Dive into Deep Learning", Amazon Science, 2021.
4. Jacek M. Zurada, "Introduction to artificial neural systems", West Publishing Co., 1992, ISBN: 0-314-93391 - 3.
5. Raúl Rojas, "Neural Networks:Asystematic Introduction" 1996.
6. Bishop C. M., ., "Pattern Recognition and Machine Learning", Springer, 2006, ISBN: 978-0-387-31073-2.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka</p> <p style="text-align: center;">(Established by an Act of the Parliament in 2009)</p> <p style="text-align: center;">School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Full Stack development			
Semester:	IV	Internal Assessment	40
Course Code:	PCACL41504	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2: 00
Credits: 4			

PREREQUISITE(S)

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

COURSE OUTCOMES

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

CO-1: Apply Javascript to build dynamic and interactive Web projects .

CO-2: Implement user interface components for JavaScript-based Web using React.JS

CO-3: Apply Express/Node to build web applications on the server side.

CO-4: Develop data model in an open source nosql database.

CO-5: Demonstrate modularization and packing of the front-end modules .

DETAILED SYLLABUS

UNIT-I

15 hrs

Basic JavaScript Instructions, Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops.

Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes, Events, Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners.

UNIT-II

15 hrs

Form enhancement and validation. Introduction to MERN: MERN components, Server less Hello world.

React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.

UNIT-III

15 hrs

React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication,

Stateless Components. Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.

UNIT-IV

15 hrs

MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB.

Modularization and Webpack ,Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle ,Hot Module Replacement, Debugging DefinePlugin: Build Configuration, Production Optimization.

Reference Books

1. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 201
3. <https://github.com/vasansr/pro-mern-stack>
4. <https://nptel.ac.in/courses/106106156>
5. <https://archive.nptel.ac.in/courses/106/105/106105084/>

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Generative AI			
Semester:	IV	Internal Assessment	40
Course Code:	PCACL41505	End Sem. Exam	60
Teaching Hours/Week (L:T:P):	3:0:2	Exam Duration (Hours)	2: 00
Credits: 4			

PREREQUISITE(S)

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

COURSE OUTCOMES

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

- CO-1: Understand generative models like autoregressive models, VAEs, and GANs.
CO-2: Learn VAEs' architecture, training, and data generation.
CO-3: Explore GANs' training, architectures, and applications in image manipulation.
CO-4: Study text generation techniques including RNNs, LSTMs, and their applications.
CO-5: Master large language models' architecture, training, fine-tuning, prompt engineering, and ethical considerations.

DETAILED SYLLABUS

UNIT-I

15 hrs

Introduction to Generative Models : Overview of generative models in artificial intelligence, Types of generative models: autoregressive models, variational autoencoders (VAEs), generative adversarial networks (GANs).

UNIT-II

15 hrs

Variational Autoencoders (VAEs): Introduction to autoencoders and variational inference, Basics of variational autoencoders (VAEs), Training VAEs and generating new data samples.

Generative Adversarial Networks (GANs): Introduction to Generative Adversarial Networks (GANs), Training GANs: generator and discriminator networks, Various architectures of GANs: DCGAN, WGAN, etc.

UNIT-III

15 hrs

Applications of GANs in image generation, image-to-image translation, etc

Text Generation: Introduction to Text Generation, Traditional Approaches to Text Generation, Statistical Language Models, Recurrent Neural Networks (RNNs) for Text Generation, Long Short-

Term Memory (LSTM) Networks, BERT, GPT, Applications in chatbots, machine translation and content generation

UNIT-IV

15 hrs

Generative AI with Large Language Models

Introduction to Large Language Models, Architecture and Training of Transformers
Fine-tuning of LLMs, Applications of Large Language Model, Introduction to Prompt Engineering, Future Trends and Opportunities in Prompt Engineering, Fine-Tuning AI Models with Custom Prompts, Ethical Considerations in Prompt Engineering, Future Trends and Opportunities in Prompt Engineering

Reference Books

1. "Deep Learning", Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press Book, November 2016.
2. "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play", David Foster, Oreilly, July 2019.
3. "Natural Language Processing with Python", Steven Bird, Ewan Klein and Edward Loper, Oreilly, Jun 2009
4. "Speech and Language Processing" by Daniel Jurafsky and James H. Martin, Pearson Edition, April 2008.
5. "Time Series Analysis and Its Applications: With R Examples", Robert H. Shumway and David S. Stoffer, Springer, November 2010.
6. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Aurélien Géron, Oreilly, October 2022.
7. "Deep Reinforcement Learning Hands-On: Apply modern RL methods to practical problems of chatbots, robotics, discrete optimization, web automation, and more, 2nd Edition", Maxim Lapan, Packt publisher, January 2020.

 CENTRAL UNIVERSITY OF KARNATAKA	<p style="text-align: center;">Central University of Karnataka (Established by an Act of the Parliament in 2009) School of Computer Sciences</p>	Dept.: CS
		MCA Course Structure & Syllabus
		2025-26

COURSE CONTENT/SYLLABUS

SEMESTER- IV

Internship, Dissertation Evaluation and Viva voce			
Semester:	IV	Internal Assessment	
Course Code:	PCAIC41400, PCARC41500	End Sem. Exam	
Teaching Hours/Week (L:T:P):		Exam Duration (Hours)	
Credits: 2 +10			

PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering.

COURSE OUTCOMES

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

- Create websites for school, PSU, Industries etc. (Level 6 Create)
- Generate the documentation of project work. (Level 6 Create)
- Develop a model that solves real time social issues. (Level 6 Create)
- Develop the module and implement the concepts of computers. (Level 6 Create)
- Sketch the data flow of project (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	1	1	2	3
CO2	2	3	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	3	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

DETAILED SYLLABUS

Project Work

Project work will be carried out either in the department or in any Institution / Industry under the supervision of guide (s) approved by the Department of Computer Science.

- 1 Each student shall carry out the project work individually and present the work done in the seminar conducted in the department at regular intervals (minimum two seminars must be conducted in the semester).
- 2 The students are required to submit three copies of the project report (dissertation) based on the work done by him/her during the project period. The project topics should be based on the syllabus or beyond.

PROJECT DISSERTATION FORMAT

SUMMARY/ ABSTRACT:

All students must submit a summary/abstract separately with the project report. Summary, preferably, should be of about 3, 4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project that the candidate is going to take up. The write up must adhere to the guidelines and should include the following:

- 1 Name / Title of the Project
- 2 Statement about the Problem
- 3 Why is the particular topic chosen?
- 4 Objective and scope of the Project
- 5 Methodology (including a summary of the project)
- 6 Hardware & Software to be used
- 7 Testing Technologies used
- 8 What contribution would the project make?

TOPIC OF THE PROJECT:

This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peep into the project to be taken up, candidates are advised to be prudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

OBJECTIVE AND SCOPE:

This should give a clear picture of the project. Objective should be Clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

PROCESS DESCRIPTION:

The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFD / Flowcharts to explain the flow of the information.

RESOURCES AND LIMITATIONS:

The requirement of the resources for designing and developing the proposed system must be given. The resources might be in form of the hardware/software or the data from the industry. The limitation of the proposed system in respect of a larger and comprehensive system must be given.

CONCLUSION:

The write-up must end with the concluding remarks briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

The following suggested guidelines must be followed in preparing the Final project Report:

Good quality white executive bond paper A4 size should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

Left margin: 3.0cms

Right margin: 2.0cms

Top margin: 2.54cms

Bottom margin: 2.54cms

Page numbers, All text pages as well as Program source code listing should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size: 10, Courier New, Normal.

Submission of Project Report to University: The student will submit his/her project report in the prescribed format. The Project Report should include:

- 1 One copy of the summary/abstract.
- 2 Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.
- 3 The Project Report may be about 75 pages (excluding coding)