Central University of Karnataka

ಕರ್ನಾಟಕಕೇಂದ್ರೀಯವಿಶ್ವವಿದ್ಯಾಲಯ

कर्नाटककेंद्रीयविश्वविद्यालय

M. C. A.

(Master of Computer Applications)

Course Structure and Syllabus

(With effect from 2023-24)

Department of Computer Science

School of Computer Science

Kadaganchi, Kalaburagi – 585 367, Karnataka State, India

CENTRAL UNIVERSITY OF KARNATAKA
(Established by an Act of the Parliament in 2009)
Kadaganchi, Kalaburagi – 585367, INDIA

Department of Computer Science
School of Computer Science Kadaganchi, Aland Road,
Kalaburagi District– 585367

MASTER OF COMPUTER APPLICATIONS (MCA)

(Effective from the academic year 2023-2024)
(For CBCS system in Central University of Karnataka, Kalaburagi)

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.

Structure of MCA Programme

MCA Semester I													
SL No	**In Sl. No**	**Sub Code**	**T/P ***	**Course Type**	**Course type**	**Title**	**Credits**	**duration (hrs)**	**L+T+P**	**Duration of End exam (Min.)**	**IA (40 %)**	**End sem. Exam (60 %)**	**Total Marks**
1	1	PCACC10100	T	Core: 1	C	Computer Organization and Architecture	5	4+2	3+1+2=6	150	50	75	125
2	2	PCACC10101	T	Core: 2	C	Programming using C	5	4+2	3+1+2=6	150	50	75	125
3	3	PCACC10102	T	Core: 3	C	Data Structures	5	4+2	3+1+2=6	150	50	75	125
4	4	PCACL10200	T	Discipline Specific Elective: I	D	Probability and Linear Algebra	4	3+2	3+0+2=5	120	40	60	100
5		PCACL10201				Programming using Python							
6		PCACL10202				Theory of Computation							
7		PCACL10203				System Software							
8		PCACL10204				Operations Research							
9		PCACL10205				Fundamentals of Web Programming							
10	5	PCATG10100	T	Generic Elective: I (for other students)	G	Fundamentals of Computers	3	3	3+0+0=3	90	30	45	75
11		PCATG10101				Web Designing							
							22	**26**					**550**

MCA Semester II													
SL No	**In Sl No**	**Sub Code**	**T/P***	**Course Type**	**Course Type**	**Title**	**Credits**	**Duration (hrs)**	**L+T+P**	**Duration of End exam (Min.)**	**IA (40%)**	**End sem Exam (60 %)**	**Total Marks**
12	1	PCACC20200	T	Core: 4	C	Database Management System	5	4+2	3+1+2=6	150	50	75	125
13	2	PCACC20201	T	Core: 5	C	Operating System	5	4+2	3+1+2=6	150	50	75	125
14	3	PCACC20202	T	Core: 6	C	Design and Analysis of Algorithms	5	4+2	3+1+2=6	150	50	75	125
15	4	PCACL20206	T	Discipline Specific Elective : II	D	Computer Graphics and Visualization	4	3+2	3+0+2=5	120	40	60	100
16		PCACL20207				Fundamentals of Artificial Intelligence							
17		PCACL20208				Data Mining							
18		PCACL20209				DOT NET Technology							
19		PCACL20210				OOPs using Java							
20	5	PCATG20200	T	Generic Elective : II	G	Introduction to Artificial Intelligence	3	3	3+0+0=3	90	30	45	75
21		PCATG20201				Introduction to Python							
							22	**26**					**550**

MCA Semester III													
SL No	**In Sl No**	**Sub Code**	**T/P ***	**Course Type**	**Course type**	**Title**	**Credits**	**duration**	**L+T+P**	**Duration of End exam (Min.)**	**IA (40%)**	**End sem. Exam (60 %)**	**Total Marks**
22	1	PCACC30300	T	Core: 7	C	Digital Image Processing	5	4+2	3+1+2=6	150	50	75	125
23	2	PCACC30301	T	Core: 8	C	Data Communication and Computer Network	5	4+2	3+1+2=6	150	50	75	125
24	3	PCACC30203	T	Core: 9	C	Software Engineering	5	4+2	3+1+2=6	150	50	75	125
25	5	PCACA30400	T	Ability Enhancement Compulsory Course	A	Neural Networks and Genetic Algorithms	5	4+2	3+1+2=6	150	50	75	125
26		PCACA30401				Fuzzy Sets and fuzzy logic							
27		PCACA30402				Pattern recognition							
28		PCACA30403				Natural language Processing							
29		PCACA30404				Modeling and Simulation							
30	6	PCAPC30400	P	Practical	C	Mini Project	2	4	0+0+4=4	60	20	30	50
							22	**28**					**550**

MCA Semester IV													
SL No	**In Sl No**	**Sub Code**	**T/P/I/R ***	**Course Type**	**Course type**	**Title**	**Credits**	**Duration (hrs)**	**L+T+P**	**Duration of End exam (Min.)**	**IA (40%)**	**End..sem. Exam (60 %)**	**Total Marks**
31	1	PCACC40500	T	Core:11	C	Machine Learning	5	4+2	3+1+2=6	150	50	75	125
32	2	PCACA40500	T	Ability Enhancement Compulsory Course	A	Internet of Things and its Applications	5	4+2	3+1+2=6	150	50	75	125
33		PCACA40501				Software Testing							
34		PCACA40502				Block Chain Technology							
35		PCACA40503				Big data and Cloud Computing							
36		PCACA40504				Deep learning							
37		PCACA40505				Mobile Computing and Network Security							
38	3	PCAIC40400	I	Internship	C	Internship	2	-		--	0	50	50
39	4	PCARC40500	R	Dissertation	C	Dissertation Evaluation and Viva voce	10	12	0+0+12=12	--	100	150	250
							22	**24**					**550**

* T- Theory, P – Practical, I- Internship, R- Dissertation.

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)**

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

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications

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 (PEOs)

	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

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACC10100**,
Title of the Course: **Computer Organization and Architecture**
L-T-P: 3-1-2 Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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 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	--	--	--

PCACC10100: Computer Organization and Architecture

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit 1 **(15 hrs)**

Number System: Introduction, Decimal, Binary, Octal, Hexadecimal, 1's and 2's Complements, Inter conversion of numbers, Codes: BCD Code, Character codes – ASCII, EBCDIC and Gray code. Binary Addition, Binary Subtraction, Signed Numbers, Addition /Subtraction of numbers in 2's complement notation, Binary Multiplication, Binary division, Floating point representation of numbers, Arithmetic operations with normalized floating point numbers.

Boolean Algebra and Logic Gates: Introduction, Basic definition, Axiomatic Definition, Basic theorem and Properties of Boolean algebra, Minterms and Maxterms, Logic Operations, Digital logic gates, IC digital logic families.

Unit 2 **(15 hrs)**

Simplification of Boolean functions: Introduction, Different types of map method, product of sum simplification, NAND or NOR implementation, don't care condition, Tabulation method.

Combinational and Sequential Circuits: Introduction, Half- adder, Full-Adder, Subtractors, Code conversion, Universal Gates, 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

Unit 3 **(15 hrs)**

Digital Components: Integrated circuits,Decoders, Decoder Expansion, Encoders, Multiplexers, Registers, Shift Registers, Counters, Binary Counter with Parallel Load, Memory Unit

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

Unit 4 **(15 hrs)**

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

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

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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: PCACC10101
Title of the Course: **Programming using C**
L-T-P: 3-1-2 Credits: 5

Prerequisite Course / Knowledge (If any):
- The students should hold fundamental knowledge of Computers.
- The students should hold the skill set of basic Mathematics.

Course Outcomes (COs)

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

CO-1: Describe about the variables and constants. (Level 2: Understand)
CO-2: Apply the concept of pointers and structures for execution of programs(Level 3: Apply)
CO-3: Understand the basics of computers. (Level 2: Apply)
CO-4: Discuss on file handling in C (Level 2: Understand)
CO-5: Describe the programming constructs in C. (Level 2: Understand)

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

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
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.

PCACC10101:**Programming using C**

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit 1 **(15 hrs)**

Introduction to computers, input and output devices, designing efficient programs. 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 typecasting.

Unit 2 **(15 hrs)**

Decision control and Looping statements: Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements, goto statement. Functions: Introduction using functions, Function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions.

Unit 3 **(15 hrs)**

Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, Two dimensional arrays, operations on two-dimensional arrays, two-dimensional arrays to functions, multidimensional arrays. Applications of arrays and introduction to strings: Applications of arrays, case study with sorting techinques. Introduction to strings: Reading strings, writing strings, summary of functions used to read and write characters.

Unit 4 **(15 hrs)**

Strings: String taxonomy, operations on strings, Miscellaneous string and character functions, arrays of strings. Pointers: Understanding the Computers Memory, Introduction to Pointers, Declaring Pointer Variables Structures: Introduction to structures, File management in C.

Reference Bools:

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The ‘C’ Programming Language, Prentice Hall of India
3. Yeshwant Kanetkar, Let us C, bpb publications
4. Computer fundamentals and programming in C “Reema Thareja”, Oxford University, Second edition, 2017

School of Computer Sciences
Department of Computer Science

Course Code: PCACC10102
Title of the Course: **Data structures**
L-T-P: 3-1-2 Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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	--

PCACC10102**: Data Structures**

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit 1 **(15hrs)**

Introduction and Array: Definition of data structure, data structure operations. Linear arrays, Representation of linear arrays in memory, Address calculation of using row and column major ordering, Traversing linear arrays, Inserting and Deleting, Multidimensional arrays: Representation of Two-Dimensional arrays in memory.

Sorting & Searching: Introduction to Algorithm, Analysis of Time complexity of Selection, Bubble, Merge, Quick, Heap Sort, and Sequential Search & Binary Search.

Unit 2 **(15hrs)**

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

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.

Unit 3 **(15hrs)**

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

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.

Unit 4 **(15hrs)**

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.

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. Sorension (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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACL10200**
Title of the Course: **Probability and Linear Algebra**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):
- The students should hold basic skills of Statistics and Mathematics.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to
1. Explain the probability theory and its theorems. (Level 2: Understand)
2. Compute the probability density function for the distributions (Level 3: Apply)
3. Solve the real time problems using algebraic operations. (Level 3: Apply)
4. Compute the Eigen value and Eigen vectors on real time requirements (Level 3: Apply)
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	--

PCACL10200: Probability and Linear Algebra

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

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.

Unit 2 **(15 hrs)**

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

Unit 3 **(15 hrs)**

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

Unit 4 **(15 hrs)**

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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACL10201**
Title of the Course: **Programming using Python**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):

- Students should have the knowledge of C and C++.
- Students should know the concept of the programming language.

Course Outcomes (COs)

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

CO1: Identify the difference between OOP and Procedural Programming. (Level 1 Remember)
CO2: Model an application's of OOP's (Level 4 Analyze)
CO3: Describe the concept of Exception handling. (Level 2 Understand)
CO4: Explain the data structure in python. (Level 2 Understand)
CO5: Apply practical experience by designing and constructing python programming. (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

PCACL10201:Programming using Python

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1: **(15 hrs)**

Object-oriented Design: Introducing object-oriented, Objects and classes, Specifying attributes and behaviors, Hiding details and creating the public interface, Inheritance, Objects in Python, Creating Python classes, Modules and packages, Organizing module contents, Who can access my data?, Third-party libraries.

Unit 2: **(15 hrs)**

When Objects Are Alike: Basic inheritance, Extending built-ins, Overriding and super, Multiple inheritance, The diamond problem, Different sets of arguments, Polymorphism, Abstract base classes, Creating an abstract base class, Demystifying the magic.

Unit 3: **(15 hrs)**

Expecting the Unexpected: Raising an exception, The effects of an exception, Handling exceptions, The exception hierarchy, Defining our own exceptions When to Use Object-oriented: Treat objects as objects, Adding behavior to class data with properties, Manager objects

Unit 4: **(15 hrs)**

Python Data Structure: Empty Object, Tuples, Dictionaries, Lists, Sets, Queues, strings and serialization, regular expressions, iterator, comprehensions, generators, testing object-oriented programs.

Reference Books:

1. Steven F. Lott, Dusty Phillips Python Object-Oriented Programming - Fourth Edition, 2021, Packt Publishing
2. Dr. R. Nageswara Rao, Core Python Programming, 2021 Dreamtech Press
3. Michael B White, Mastering Python: Machine Learning, Data Structures, Django, Object Oriented Programming and Software Engineering [2nd Edition] 2019 Newstone
4. Martin C. Brown, Python: The Complete Reference, 2019, McGraw Hill Education; Forth edition

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACL10202**
Title of the Course: **Theory of Computation**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):

- 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	--

PCACL10202: Theory of Computation

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(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 2 **(10 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 3 **(20 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 liner to right linear regular grammar, equivalence of regular gramma and finite automata.

Unit 4 **(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 out 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*, IInd 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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACL10203**
Title of the Course: **System Software**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):

- The students should hold knowledge of software and hardware.

Course Outcomes (COs)

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	--

PCACL10203: System Software

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

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 2 **(15 hrs)**

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

Unit 3 **(15 hrs)**

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.

Unit 4 **(15 hrs)**

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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACL10204**
Title of the Course: **Operations Research**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):
- The students should hold basic knowledge of statistics.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to
1. Describe the principles of operation research. (Level 2: Understand)
2. Apply LPP on real time requirements. (Level 3: Apply)
3. Solve real time problems using the Transportation and Assignment approach. (Level 3: Apply)
4. Explain Game theory in real time applications. (Level 2: Understand)
5. Discuss on network analysis techniques. (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	--	--	--	1	--	2	2
CO2	2	3	2	--	1	--	2	1	2	--
CO3	3	2	2	--	1	--	2	--	3	1
CO4	3	3	2	2	1	1	1	--	3	--
CO5	1	2	2	--	1	--	1	--	2	--

PCACL10204: Operations Research

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Scope and applications, classification, General methods for solving Operations Research models, Main phases of OR study, Introduction to Linear Programming: Two variable LP model, formulation (both minimization and maximization), Solution – graphical method, General LPP and applications.

Unit 2 **(15 hrs)**

The Simplex Method: LP model inequation form, Transition from Graphical to Algebraic Solutions, the simplex method in tabular form, special cases in the simplex method, tiebreaking in the simplex method, adopting to other model forms (Two Phase method, Big-M method).

Concept of duality: Formulation of dual LPP, Duality theorem, advantages of duality, dual simplex algorithm and sensitivity analysis,

Unit 3 **(15 hrs)**

Transportation Problem: Introduction, Formulation, Necessary and sufficient condition for the existence of feasible solution to a transportation problem, Initial basic feasible solution by NWCR, LCM and VAM, Optional solution using U V method, Algorithm and flowchart for minimization transportation problem.

Assignment Problem: Formulation, Optimal solution using Hungarian algorithm. Traveling salesman problem, Variations of the assignment problems.

Unit 4 **(15 hrs)**

Game Theory: Basic definitions, minmax–maxmin principle and optimal strategy, Solution of games with saddle point, dominance rule for solving a two person game.

Network Analysis: Network and basic components, Rules for network construction, basic steps in PERT/CPM techniques and applications, time estimates and critical path in network analysis.

Reference Books:

1. Taha H.A (2017), *Operations Research: An Introduction*, 10th Edition, Pearson.
2. Billy E. Gilett, (1984), *Introduction to Operations Research*, McGraw-Hill.
3. Sharma (2009), *Operations Research: Theory and Applications*, Laxmi Publications.
4. Hillier F. S. (2017) *Introduction to Operations Research*, 10th Edition, McGraw-Hill.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACL10205**
Title of the Course: **Fundamentals of Web Programming**
L-T-P: 3-0-2 Credits: 4

Prerequisite course / Knowledge (if any):

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

Course outcomes (COs)
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

PCACL10205: Fundamentals of Web Programming

Credits: 4 **IA: 40 Marks**

Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(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.

Unit 2 **(15 hrs)**

Cascading Style Sheets Basics: 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 3 **(15 hrs)**

Graphics & Text Styling Basics: Web Graphics, Image Element, CSS Interactivity with Pseudo-Classes, Practice with CSS Two-Column Layout, CSS for Print, CSS Sprites, Positioning with CSS, Practice with Positioning, Fixed Position Navigation Bar.

Unit 4 **(15 hrs)**

JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions.

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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCATG10100**
Title of the Course: **Fundamentals of Computers**
L-T-P: 3-0-0 Credits: 3

Prerequisite Course / Knowledge (If any):

- Students should have basic knowledge of electronics.

Course Outcomes (COs)

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	--

PCATG10100: Fundamentals of Computers

Credits: 3 **IA: 30 Marks**
Contact Hrs (L:T:P): 3 (3:0:0) **End Exam: 45 Marks**

Unit 1 **(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.

Number system: Binary Octal, Hexa-decimal, Number base conversion, Binary addition, Subtraction, One's and Two's compliment, Character codes – ASCII, EBCDIC.

Unit 2 **(15 hrs)**

Data processing: concepts of data processing, Definition of Information and data, Basic data types, Storage of data/Information as files, Representation of data/Information.

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.

Unit 3 **(15 hrs)**

Operating system and Microsoft Windows: Definition & functions, basics of Windows, components of windows, icons, types of icons, taskbar, activating windows, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders, Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance, windows accessories.

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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCATG10101**
Title of the Course: **Web Designing**
L-T-P: 3-0-0 Credits: 3

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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	--	--	--

PCATG10101: Web Designing

Credits: 3 **IA: 30 Marks**
Contact Hrs (L:T:P): 3 (3:0:0) **End Exam:45 Marks**

Unit 1 **(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 2 **(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 3 **(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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACC20200**
Title of the Course: **Database Management System**
L-T-P: 4-0-2 Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

PCACC20200: Database Management System

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(15 hrs)**

Databases and Users: Introduction, File oriented approach, characteristics of Database approach, advantages of DBMS over File Processing System. Implications of database approach, when not to use a DBMS.

Database System Concepts and Architecture: Data Models, Schemas and Instances, DBMS Architecture and Data Independence- the Three Schema Architecture, Data Independence, DBMS languages and interfaces, The Database System Environment, Classification of DBMS.

Unit 2 **(15 hrs)**

ER-Model: Entity Types, entity sets, attributes and keys, Relationships, Relationship types, Roles and constraints, Weak entities, ER Diagrams Naming Conventions and Design Issues, ER Diagram for company Database, Case Studies: Insurance policy management system, Library Management system.

The Relational Data Model & Relational Constraints: Relational model concepts, Relational Constraints and Relational Database Schemas.

Relational Algebra Operation: Introduction, unary relational operation-select and project, Relation algebra operations from Set Theory-Union, intersection and minus operation, Cartesian product operation, Binary relational operations: Join and division, The Division operation.

Unit 3 **(15 hrs)**

SQL Schema Definition, Constraints, Queries and Views: SQL Data Definition and data types, specifying constraints in SQL, schema Change statement in SQL, basic queries in SQL, more complex SQL queries, INSERT, DELETE, AND UPDATE statements in SQL. Specifying constraints and assertions and triggers.

Functional Dependencies and Normalization of Relational Databases: Informal Design guidelines for Relation Schemas, functional dependencies, Normal Forms: 1NF, 2NF, 3NF AND BCNF, Multi valued Dependencies and fourth Normal Form, Join Dependencies and fifth Normal form.

Unit 4 **(15 hrs)**

Introduction to Transaction Processing Concepts and Theories: Introduction to transaction processing, transaction and system concepts, Desirable properties of transaction, characterizing schedules based on recoverability, and characterizing schedules based on serializability.

Concurrency Control Techniques: Lock based concurrency control, Deadlocks, implementation of locking, Multiversion concurrency control techniques, and validation concurrency control Techniques.

Database Recovery Techniques: Recovery concepts, recovery techniques based on Deferred update. Database security: Introduction to database security, discretionary access control, mandatory access control, and statistical database.

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 Cocepts,* 5th Edition, Mc-Graw Hills.
5. C.J. Date (2003), *Introduction to database systems*, 8th Edition, Addison Wesley.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACC20201**
Title of the Course: **Operating System**
L-T-P: 4-0-2 Credits: 5
Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

After completion of this course successfully, the students will be able to
CO-1: Review the basic concepts of operating system. (Level 2: Understand)
CO-2: Illustrate the examples on processor scheduling and deadlock prevention. (Level 3: Apply)
CO-3: Justify the demand paging concepts for the comparison of page replacement algorithms.(Level 5: Evaluate)
CO-4: Describe the disk scheduling algorithms 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	--

PCACC20201:Operating System

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(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 2 **(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 3 **(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 4 **(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.

Protection: Goals, mechanism and policies, domain of protection, access matrix and its implementation, dynamic protection structure, revocation, security.

Reference Books:

1. J. Sliberschatz (2006), *Operating systems Concepts*, McGraw Hill.
2. Madnick, S.E. Donovan J.J. (1974), *Operating system*, McGraw Hill.
3. Brinch Hansen P (1973), *Operating system Principles*, PHI.
4. Milan Milenkovic (2001), *Operating systems*, McGraw Hill.
   William Stallings (2018), *Operating system Internals and Design Principles,* Pearson.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACC20202**
Title of the Course: **Design and Analysis of Algorithms**
L-T-P: 4+0+2=6 Credits: 5

Prerequisite Course / Knowledge (If any):

- Students should have fundamental knowledge of programming and mathematics.
- Students should have knowledge of data structures.

Course Outcomes (COs)

At the end of the course the student will be able to:
CO 1. Analyze the performance of the algorithms, state the efficiency using asymptotic notations and analyze mathematically the complexity of the algorithm.
CO 2. Apply divide and conquer approaches and decrease and conquer approaches in solving the problems analyze the same
CO 3. Apply the appropriate algorithmic design technique like greedy method, transform and conquer approaches and compare the efficiency of algorithms to solve the given problem.
CO 4. Apply and analyze dynamic programming approaches to solve some problems. and improve an algorithm time efficiency by sacrificing space.
CO 5. Apply and analyze backtracking, branch and bound methods and to describe P, NP and NP-Complete problems.

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

PCACC20202: Design and Analysis of Algorithms

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1: **(15 Hrs)**

Introduction: What is an Algorithm? 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 () 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 2: **(15 Hrs)**

Divide and Conquer: General method, Recurrence equation for divide and conquer, solving it using Master's theorem. , Divide and Conquer algorithms and complexity Analysis of Finding the maximum & minimum, Binary search, Merge sort, Quick sort.

Decrease and Conquer Approach: Introduction, Insertion sort, Graph searching algorithms, Topological Sorting. It's efficiency analysis.

Unit 3: **(15 Hrs)**

Greedy Method: General method, Coin Change Problem, Knapsack Problem

Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm with performance analysis.

Single source shortest paths: Dijkstra's Algorithm.

Optimal Tree problem: Huffman Trees and Codes.

Transform and Conquer Approach: Introduction, Heaps and Heap Sort.

Unit 4: **(15 Hrs)**

Dynamic Programming: General method with Examples, Multistage Graphs.

Transitive Closure: Warshall's Algorithm. **All Pairs Shortest Paths**: Floyd's Algorithm, Knapsack problem, Travelling Sales Person problem.

Space-Time Tradeoffs: Introduction, Sorting by Counting

Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, **Branch and Bound**: Assignment Problem, Travelling Sales Person problem

NP-Complete and NP-Hard problems: Basic concepts, non- deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

Reference Books

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACL20206**
Title of the Course: **Computer Graphics and Visualization**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):
- The students should have the basic knowledge of computers and programming.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to
CO-1: Describe the basic display devices and input devices. (Level 2 Understand)
CO-2: Explain drawing algorithms for line, circle, ellipse etc. 2D transformations, line and polygon clipping, color fill methods, and 2D projections. (Level 2 Understand)
CO-3: Explain 2- dimensional graphical objects using geometrical algorithms and performs operations on them. (Level 2 Understand)
CO-4: Employ the introduction of Fractal Graphics. (Level 3 Apply)
CO-5: Experiment the Computer Graphics algorithms using OpenGL. (Level 4 Analyze)

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

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

PCACL20206: Computer Graphics and Visualization

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

A Survey of Computer Graphics, Overview of Graphics systems: Video Display Devices, Raster-Scan System, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Graphics Software.

Unit 2 **(15 hrs)**

Points and Lines, Line-Drawing Algorithms, Circle-Generating Algorithms, Ellipse-Generating Algorithms, Curve Algorithms, Pixel Addressing, Filled-Area Primitives, Line Attributes, Colour and Grayscale Levels, Area-Fill Attributes.

Unit 3 **(15 hrs)**

Two-Dimensional Transformation: Mathematical treatment of basic transformation such as translation, scaling and rotation. Development of composite transformation matrices using homogeneous coordinates. General fixed point scaling and pivot point rotation.Clipping: Study of Cohen Sutherland line clipping procedure and Sutherland Hodgmen polygon clipping procedure.Windows and Viewports: Derivation of generalized window to viewport transformation matrix.Three-Dimensional Computer Graphics: Introduction to left and right hand coordinate systems. Basic 3D-transformation. **Projection:** Study of orthographic and oblique parallel transformation equations for them.

Unit 4 **(15 hrs)**

Colour Models and Colour Applications: Intuitive Colour Concepts, RGB Colour Model, YIQ Colour Model, Conversion Between HSV and RGB Models, Colour Selection and Applications, Computer Animation, Design of Animation Sequences, General Computer-Animation Functions, Raster Animations, Computer-Animation Languages, Key-Frame Systems, Morphing, Simulating Accelerations, Motion Specifications, Direct Motion Specification.

Reference Books:

1. Hearn Donald, Pauling Baker. M (1998), *Computer Graphics*, IEEE PHI.
2. Newman and Sproull (1996), *Principles of Interactive Computer Graphics*, McGraw Hill.
3. S. Harrington (1997), *Computer Graphics*, McGraw Hill.
4. Donald Hearn, M. Pauline Baker (2014), *Computer Graphics C Version*, Pearson Education.
5. Peter Shirley, Michael Ashikhmin (2009), *Fundamentals of Computer Graphics*, 3rd Edition, A K Peters/CRC Press.
6. Philip J Schneider, David H Eberly, *Geometric Tools for Computer Graphics.*

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCACL20207**
Title of the Course: **Fundamentals of Artificial Intelligence**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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	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

PCACL20207: Fundamentals of Artificial Intelligence

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(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 2 **(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 unformed Search strategies**, Informed search strategies**: Greedy best-first search, A* Search, AO* Search, Heuristic Function

Unit 3 **(15 hrs)**

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 4 **(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”, SecondEdition, 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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACL20208**
Title of the Course: **Data Mining**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):
· The students should hold basic knowledge of Computer Programming. · The students should hold the skill set of basic Statistics.

Course Outcomes (COs)

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

1. Summarize the concepts of Data mining. (Level 5: Evaluate)
2. Experiment on Simplification of data mining.
3. (Level 4: Analyze)
4. Prepare a preprocessing and classification of data. (Level 3: Apply)
5. Describe the basic concepts of clustering. (Level 2: Understand)
6. Discuss the structure of neural network and applications. (Level 2: Understand)

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**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	--	--	--

PCACL20208: Data Mining

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1: **(15 Hrs)**

Introduction : Definition**,** Basic Data Mining Tasks, Classification, Regression, Time Series Analysis , prediction , Clustering, Summarization , Association Rules, Sequence Discovery, Data Mining Versus Knowledge Discovery in Databases, The Development of Data Mining, Data Mining Issues, Data Mining, Social Implications of Data Mining , Data Mining from a Database Perspective .

Unit 2: **(15 Hrs)**

Data Mining Techniques: A Statistical Perspective on Data Mining, Similarity Measures, Decision Trees, Neural Networks, And Genetic Algorithms.

Classification: Introduction, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule Based Algorithms

Unit 3: **(15 Hrs)**

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Algorithms, Agglomerative Algorithms, Divisive Clustering, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

Unit 4: **(15 Hrs)**

Association Rules: Basic Algorithms, Parallel and Distributed Algorithms, Comparing Approaches, Advanced Association Rule Techniques

Sequential Pattern mining, Text Mining, Web mining, time series mining

Reference Book:

1. Data Mining – Introductory and Advanced Topics, Margaret H. Dunham, Pearson Education., Prentice Hall 2003.
2. Data warehousing, Data mining and OLAP by Alex Berson & Stephon J. Smith, Tata McGraw Hill.2003
3. Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal, Data Mining: Practical Machine Learning Tools and Techniques 4th Edition, Morgan Kaufmann
4. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques 3ed, 2007 Elsevier

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code:**PCACL20209**
Title of the Course: **DOT NET Technology**
L-T-P: 3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):
The students should hold basic knowledge of Computer Programming.
The students should hold the skill set of basic OOP's concepts.

Course Outcomes (COs)

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

1. Summarize the concepts of dot net technology. (Level 5: Evaluate)
2. Experiment on construction of GUI applications. (Level 4: Analyze)
3. Prepare constructors and destructors . (Level 3: Apply)
4. Describe the basic concepts of ASP.NET (Level 2: Understand)

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**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	--

PCACL20209: DOT NET Technology

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1: **(15 Hrs.)**
Introducing C# and the .NET Framework: Object Orientation; Type Safety; Memory Management; Platform Support; C# and CLR; CLR and .NET Framework; Other Frameworks; Framework Overview; .NET Standard 2.0; Applied Technologies

Unit 2: **(15 Hrs.)**
The C# Language Basics: Writing Console and GUI Applications; Identifiers and Keywords; Writing Comments; Data Types; Expressions and Operators; Strings and Characters; Arrays; Variables and Parameters; Statements (Declaration, Expression, Selection, Iteration, and Jump Statements); Namespaces

Unit 3: **(15 Hrs.)**
Creating Types in C#: Classes; Constructors and Deconstructors; this Reference; Properties; Indexers; Static Constructors and Classes; Finalizers; Dynamic Binding; Operator Overloading; Inheritance; Abstract Classes and Methods; base Keyword; Overloading; Object Type; Structs; Access Modifiers; Interfaces; Enums; Generics

Unit 4: **(15 Hrs.)**
Advanced C# : Delegates; Events; Lambda Expressions; Exception Handling; Introduction of LINQ; Working with Databases; Writing Web Applications using ASP-NET

Reference Books:

1. C# 7.0 All-in-One For Dummies (1st Editiion), John Paul Mueller, Bill Sempf, Chuck Sphar, John Wiley & Sons, Inc.
2. Professional C# 7 and .NET Core 2.0 (7th Edition), Christian Nagel, John Wiley & Sons, Inc.
3. C# 7.0 in a Nutshell (7th Edition), the Definitive Reference, Joseph Albahari & Ben Albhari, O'Reilly.
4. Microsoft Visual C# Step by Step (9th Edition), John Sharp, Pearson Education.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications

Course Code: **PCACL20210**
Title of the Course: **OOP'S Using Java**
L-T-P =3-0-2 Credits: 4

Prerequisite Course / Knowledge (If any):

- Students should have the knowledge of procedure oriented programming.

Course Outcomes (COs)

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)

	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO10
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

PCACL20210 : OPPs using Java

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 5 (3:0:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Fundamentals of Object Oriented Programming: Basic Concepts of Object Oriented Programming, Benefits and Applications of OOP, Comparison of Object Oriented Programming Languages.

The Genesis of Java: The Java Buzzwords, Java's lineage (Needs of C and C++ and its Comparison with java), Basic Data Types Of Java and Simple programs, Command line Arguments, Why java is Important to the Internet, Java's Magic:-The Byte code.

Arrays, Strings and Vectors: Declaration, Creation and operations on One and Two-Dimensional Arrays. The String Classes and its commonly used methods, Vectors and Wrapper Classes.

Unit 2 **(15 hrs)**

Introducing Classes and Objects: Class Fundamentals, Declaring Object, Assigning object reference variables, Static variables and Static Methods. Constructors-Its Characteristics and Features, Overloaded Constructors and the 'this' keyword.

Inheritance: Inheritance Basics, Concepts of Sub-class and Super-class. Constructing a Sub-class with the use of the keywords extends, super and final. Method Overriding and Access Modifiers.

InterfacesandPackages: Interfaces- TheirUseinMultiple inheritance, Defining and implementing interfaces with examples. Packages- Java API Packages, Use of Import Statements and Package Creation, Defining and implementing packages with examples.

Unit 3 **(15 hrs)**

Exception Handling: Fundamentals, Exception Types, Using try and catch blocks. Multiple catch clauses, Use of throw, throws and finally. Java Built-in Exceptions and Creating Own-Exception sub-classes.

Multi-threaded Programming: Concept of Parallel and Multitasking, Creating Thread, Creating Multiple Threads, Thread Priorities and Synchronization.

Unit 4 **(15 hrs)**

Applet Class: Fundamentals of Applets, Creations and Execution. Methods of applet. The HTML applet Tag, Passing parameters to applets.

Introducing the AWT:AWT Classes Windows Fundamentals, Working with Graphics and Setting fonts and colors.

Using AWT Controls: Event Handling-The Delegation Event Model, Event Classes and Event Listener interfaces. Form Elements- Labels, Text-Fields, Buttons, Checkboxes, Checkbox Group, Choice, List and Scrollbars. Their associated Methods and events.

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.

School of Computer Sciences

Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code:**PCATG20200**
Title of the Course: **Introduction to Artificial Intelligence**
L-T-P: 3-0-0 Credits: 3

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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	--	--	--

PCATG20200: Introduction to Artificial Intelligence

Credits: 3 **IA: 30 Marks**
Contact Hrs (L:T:P): 3 (3:0:0) **End Exam: 45 Marks**

Unit 1 **(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.

Unit 2 **(15 hrs)**

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

Unit 3 **(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.

Reference 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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCATG20201**
Title of the Course: **Introduction to Python**
L-T-P: 3-0-0 Credits: 3

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of computers and programming.

Course Outcomes (COs)

After completion of this course successfully, the students will be 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

PCATG20201: Introduction to Python

Credits: 3 **IA: 30 Marks**
Contact Hrs (L:T:P): 5 (3:0:0) **End Exam: 45 Marks**

Unit 1 **(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,

Unit2 **(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.

Unit3 **(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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACC30300**
Title of the Course: **Digital Image Processing**
L-T-P: 4+0+2 Credits: 5
Prerequisite Course / Knowledge (If any):

- Fundamental of Computer graphics and basic knowledge of python/Matlab.
- Students should have basic knowledge of mathematics.

Course Outcomes (COs)

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

PCACC30300: Digital Image Processing

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(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 2 **(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 3 **(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 4 **(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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACC30301**
Title of the Course: **Data Communication and Computer Network**
L-T-P: 4-0-2 Credits: 5

Prerequisite Course / Knowledge (If any):

- The students should hold basic knowledge of Computer Fundamentals.
- The students should hold the skill set of basic network concepts.

Course Outcomes (COs)

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

1. Summarize the concepts of physical layer and media (Level 5: Evaluate)
2. Experiment on analog transmission and applications. (Level 4: Analyze)
3. Prepare a Computer Network and establish internet connection. (Level 3: Apply)
4. Describe the basic concept of wireless network (Level 2: Understand)

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**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	--

PCACC30301: Data Communication and Computer Network

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1: **(15 hrs)**

Physical Layer & Media: Analog and Digital, Periodic analog signals, Digital signals, Transmission of Digital Signals, Transmission impairment, Data rate limits, performance. Digital Transmission: Digital-to-digital conversion, analog-to-digital conversion, transmission modes Parallel Transmission Serial Transmission Analog Transmission: Digital-to-analog conversion, Analog-to-analog conversion Bandwidth Utilization: Multiplexing & Spreading: Multiplexing spread spectrum

Unit2 **(15 hrs)**

Transmission Media: Guided media, unguided media, Circuit-switched networks: Circuit-Switched Networks, Datagram networks, virtual-circuit networks, Data Link Layer: Error Detection and Correction, Introduction, Block Coding, Linear block codes, cyclic codes, Checksum.

Unit 3 **(15 hrs)**

Computer Networks and the Internet: what is the Internet? What is a Protocol? Application Layer: Introduction, Network application architecture, process communication, HTTP, File Transfer: FTP, Electronic Mail in the Internet, SMPP, DNS Transport Layer: Introduction, Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, Connectionless Transport: UDP, Principles of Reliable of Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.

Unit-4: **(15 hrs)**

Network Layer and Routing: Introduction and Network Service Model, virtual circuits and datagrams, what is inside the router? Internet protocol (IP), Forwarding & Addressing in internet, Routing Algorithms, Routing in the internet, Broad & Multicast Routing.

Wireless & Mobile Networks: Introduction: Wireless Links & Networks characteristics, Wi-Fi, Cellular Internet Access, Mobility Management, Mobile IP, Managing mobility in cellular networks, Wireless & mobility.

Reference Books:

1. Data Communications & Networking Fourth Edition, Behrouz A Forouzan
2. Computer Networking" Third Edition, James F. Kurose, Keith W. Ross

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACC30203**
Title of the Course: **Software Engineering**
L-T-P: 4+0+2=6 Credits: 5
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and image processing techniques.

Course Outcomes (Cos)

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

CO-1. Explain the role of software. (Level 2 Understand)
CO-2. Analyse the software process and project metrics. (Level 3 Apply)
CO-3. Discuss the software project planning, management and principles. (Level 2 Understand)
CO-4. Use the software testing techniques and strategies. (Level 3 Apply)
CO-5. Explain the software configuration management.(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	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	--	--	--

PCACC30203:SOFTWARE ENGINEERING

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(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.

Project Management Concepts: The Management Spectrum, The People, The Product, The Process, and The Project, W5HH Principle.

Software Process and Project Metrics: Measures, Metric Indicators, Metric in process and the Project Domains ,Software Measurement, Metrics for software quality.

Unit 2 **(15 hrs)**

Software Project Planning: Project Planning Objectives, Software Project Estimation, decomposition Techniques, Empirical Estimation Models.

Risk Analysis and Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement and Risk Mitigation, Monitoring, and Management.

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

Unit 3 **(15 hrs)**

Analysis Modeling: Elements of analysis model, data modeling, functional modeling, behavioral modeling, the mechanics of structured analysis, data dictionary, other classical analysis methods.

Design Concepts and Principles: Software design and software engineering design process, design principles, design concepts, design methods, data design, architectural design and process, transform and transaction mappings, design post processing, architectural design optimization, interface design, procedural design.

Software Testing Techniques and Strategies: Fundamentals, Test case design, White box testing, Basis path testing, Control structure testing, Black box testing, Software testing strategies.

Unit-4 **(15 hrs)**

Software Configuration Management: Configuration management, maintenance costs, maintenance side effects, maintenance tissues.

Software Quality Assurance: Quality Concepts,

Software Quality Assurance, FTR, ISO 9001, ISO9002, ISO-9003, Introduction to CASE, DOD standard 2167 A.

Reference Books:

1. Software Engineering, Fifth Edition, Roger - Pressman, McGraw Hill.
2. Software Engineering , I Sommerville, International Computer Science, Series
3. Object Oriented Modeling and Design, Rumbaugh. J., Blaha M., Premerlani W., Eddy F and Lorensen W.,PHI.
4. Software Engineering, Schooma, McGraw Hill
5. Object Oriented Design and Analysis, Booch, Benjamin / Cummings.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACA30400**
Title of the Course: **Neural Networks and Genetic Algorithms**
L-T-P: 4+0+2 Credits: 5
Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

CO-1. Memorize the concepts of Neuroscience. (Level 1 Remember)
CO-2. Explain the Memory problem and capacity of stochastic network. (Level 2 Understand)
CO-3. Develop the optimization problems in image processing. (Level 6 Create)
CO-4. Design the theoretical framework for generalization and optimal network architectures for computation problems. (Level 6 Create)
CO-5. Use of the genetic algorithm. (Level 1 Remember)

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

PCACA30400: Neural Networks and Genetic Algorithms

Credits: 5 **IA: 50 Marks**
Contact Hrs (L: T:P): 6 (4:0:2) **End Exam: 75Marks**

Unit 1 **(15 hrs)**

Introduction: Inspiration from Neuroscience, History, The Hopfield Model, The Associative Memory Problem, Statistical Mechanics of Magnetic Systems, Stochastic Networks, Capacity of the Stochastic Network, Correlated Patterns.

Unit 2 **(15 hrs)**

Optimization Problems: The Weighted Matching Problem, The Travelling Salesman Problem, Graph Bipartitioning, Optimization Problems in Image Processing.

Unit 3 **(15 hrs)**

Simple Perceptrons: Feed-Forward Networks, Threshold Units, Linear Units, Nonlinear Units, Stochastic Units, Multi-Layer Networks: Back-Propagation, Variations on Back-Propagation, Examples and Applications, Performance of Multi-Layer Feed-Forward Networks, A Theoretical Framework for Generalization, Optimal Network Architectures.

Unit 4 **(15 hrs)**

Genetic Algorithm – What are Genetic Algorithms, Where to use Genetic Algorithm?,the general idea, How the Genetic algorithm works, survival of the fittest, pictures computations, cross over, mutation, reproduction, rank method, rank space method, application.

Reference Books:

1. John Hertz, Anders Krogh and Richard G. (1991), *Introduction to the theory of neural computation,* Elsevier Science Publishers.
2. Melanie Mitchell,(1999), *An Introduction to Genetic Algorithms*, The MIT Press
3. S. Rajasekaran, G. A. Vijayalakshmi Pai (2012), *Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications*, PHI.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACA30401**
Title of the Course: **Fuzzy Sets and Fuzzy Logic**
L-T-P: 4+0+2=6 Credits: 5
Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

CO-1. Explain the difference between crips 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	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	2
CO3	3	3	3	2	1	1	1	3	2	3
CO4	2	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

PCACA30401: Fuzzy Sets and Fuzzy Logic

Credits: 5 **IA: 50 Marks**
Contact Hrs (L: T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(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 a-Cuts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets.

Unit 2 **(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 3 **(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 4 **(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
3. S.N. Sivanandam, S. Sumathi, S. N. Deepa (2006), *Introduction to Fuzzy Logic using MATLAB,* Springer
4. David Edward Goldberg, Addison(1989), *Genetic Algorithms in Search, Optimization, and Machine Learning,* Wesley Publishing Company.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACA30402**
Title of the Course: **Pattern Recognition**
L-T-P: 4+0+2 Credits: 5
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of basic mathematics.
- Students should have knowledge of Computer Graphics.

Course Outcomes (COs)

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

PCACA30402: Pattern Recognition

Credits: 5 **IA: 50 Marks**
Contact Hrs (L: T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(15 hrs)**

Introduction: Applications of pattern recognition, statistical decision theory, image processing and analysis.

Probability: Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

Unit 2 **(15 hrs)**

Statistical Decision Making: Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leaving one out technique. Characteristic curves, estimating the composition of populations. Non-**parametric Decision Making:** Introduction, histograms, Kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminant Functions, minimum squared error discriminant functions, choosing a decision making technique.

Unit 3 **(15 hrs)**

Clustering: Introduction, hierarchical clustering, partitional clustering.

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

Unit 4 **(15 hrs)**

Processing of Wave-forms And Images: Introduction, gray level sealing 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

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACA30403**
Title of the Course: **Natural Language Processing**
L-T-P: 4+0+2 Credits: 5
Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

PCACA30403: Natural Language Processing

Credits: 5 **IA: 50 Marks**
Contact Hrs (L: T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit 1 **(15 hrs)**

Regular Expressions and Automata, Morphology and Finite-State Transducers, Computational Phonology and Text-to-Speech.

Unit 2 **(15 hrs)**

Probabilistic Models of Pronunciation and Spelling, N-grams, HMMs and Speech Recognition. Word Classes and Part-of-Speech Tagging, Context-Free Grammars for English, Parsing with Context-Free Grammars, Features and Unification.

Unit 3 **(15 hrs)**

Lexicalized and Probabilistic Parsing, Language and Complexity, Representing Meaning, Semantic Analysis, Lexical Semantics, Word Sense Disambiguation and Information Retrieval, Pragmatics, Discourse, Dialogue and Conversational Agents, Generation.

Unit 4 **(15 hrs)**

Machine Translation, A Regular Expression Operators, The Porter Stemming Algorithm,Training HMMs: The Forward-Backward Algorithm.

Reference Books:

1. Daniel Jurafsky and James H. Martin (2002), *Speech and Language Processing: An Introduction To Natural Language Processing, Computational Linguistics And Speech Recognition*, Pearson Education.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal (1995), *Natural Language Processinga Paninian Perspective*. Prentice Hall India.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACA30404**
Title of the Course: **Modeling and Simulation**
L-T-P: 4-0-2 Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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	--	--	--

PCACA30404:Modeling and Simulation

Credits: 5 **IA: 50 Marks**
Contact Hrs (L: T:P): 6 (4:0:2) **End Exam: 75 Marks**

Unit-I **(20 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 **(10 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, Bankds 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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCAPC30400**
Title of the Course: **Mini-Project**
L-T-P: 0+0+4 Credits: 2
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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCACC40500**
Title of the Course: **Machine Learning**
L-T-P: 3+1+2 Credits: 5
Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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	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

PCACC40500: Machine Learning

Credits: 5 **IA: 40 Marks**
Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Basics: Introduction to Machine Learning – Different Forms of Learning, Basics of Probability Theory, Linear Algebra and Optimization.

Regression Analysis: Linear Regression, Ridge Regression, Lasso, Bayesian Regression, Regression with Basis Functions.

Unit 2 **(15 hrs)**

Classification Methods: Instance-Based Classification, Linear Discriminant Analysis, Logistic Regression, Large Margin Classification, Kernel Methods, Support Vector Machines, Multi-class Classification, Classification and Regression Trees.

Neural Networks: Non-linear Hypotheses, Neurons and the Brain, Model Representation, Multi-layer Networks, Back-propagation, Multi-class Discrimination, Training Procedures, Localized Network Structure, Deep Learning.

Unit 3 **(15 hrs)**

Graphical Models: Hidden Markov Models, Bayesian Networks, Markov Random Fields, Conditional Random Fields.

Ensemble Methods: Boosting - Adaboost, Gradient Boosting, Bagging - Simple Methods, Random Forest.

Clustering: Partitional Clustering - K-Means, K-Medoids, Hierarchical Clustering, Agglomerative, Divisive, Distance Measures, Density Based Clustering – DBscan,Spectral Clustering.

Unit 4 **(15 hrs)**

Dimensionality Reduction: Principal Component Analysis, Independent Component Analysis, Multidimensional Scaling, and Manifold Learning.

Reinforcement Learning: Q-Learning, Temporal Difference Learning

Reference Books:

1. Christopher M. Bishop (2006), *Pattern Recognition and Machine Learning,* 1st ed, Springer.
2. John Paul Mueller and Luca Massaron (2016), *Machine Learning*, 1st Edition, Dummies
3. U Dinesh Kumar and Manaranjan Pradhan (2020), *Machine Learning using Python*, Wiley.
4. John Paul Mueller and Luca Massaron (2016), *Machine Learning (in Python and R),* Wiley.
5. R.O. Duda, P.E. Hart and D.G. Stork (2001), *Pattern Classification,* Wiley.

School of Computer Sciences

Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCACA40500**

Title of the Course: **Internet Of Things and Its Applications**

L-T-P: 3+1+2= Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (Cos)

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

Course Learning Outcomes:

1. To interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. To compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. To appraise the role of IoT protocols for efficient network communication.
4. To elaborate the need for Data Analytics and Security in IoT

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

PCACA40500: Internet Of Things and Its Applications

Credits: 5 **IA: 50 Marks**

Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit-1 **(15 hrs)**

Introduction : What is 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-2 **(15hrs)**

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-3 **(15hrs)**

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-4 **(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.

References

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

School of Computer Sciences

Department of Computer Science

Name of the Academic Program: Master of Computer Applications

Course Code: **PCACA40501**

Title of the Course: **Software Testing**

L-T-P: 3-1-2 Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

1. To understand the basics of testing and its features (Level 1 Remember
2. To demonstrate the implementation of white box and black box testing (Level 4 Analyze)
3. To Describe the different types of testing and its importance in testing the real time product (Level 2 Understand)
4. To define the regression testing and its benefits (Level 2 Understand)
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

PCACA40501: Software Testing

Credits: 5 **IA: 50 Marks**
Contact Hrs (L:T:P): 4 (3:1:2) **End Exam: 75 Marks**

Unit-I: Introduction **(15 hrs)**

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: Test case Design Methods **(15 hrs)**

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: System, Integration and Acceptance Testing **(15 hrs)**

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: Regression Testing Process **(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.

References:

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

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications
Course Code: **PCACA40502**
Title of the Course: **Block chain Technology**
L-T-P: 3-1-2 Credits: 5

Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

CO-1: Describe the basic concepts and technology used for blockchain.
CO-2: Describe the primitives of the distributed computing and cryptography related to blockchain.
CO-3: Illustrate the concepts of Bitcoin and their usage.
CO-4: Implement Ethereum block chain contract.
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	--	--	--

PCACA40502: Block Chain Technology

Credits: 4 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit 1 **(15 hrs)**

Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash

Unit 2 **(15 hrs)**

Basic Distributed Computing & Crypto primitives: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems Bitcoin basics:Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

Unit 3 **(15 hrs)**

Ethereum basics:Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript

Unit 4 **(15 hrs)**

Privacy, Security issues in Blockchain:Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks

Reference Books:

1) Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurren Technologies – A Comprehensive Introduction", Princeton University Press.
2) Josh Thompson, 'Blockchain: The Blockchain for Beginnings, 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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code:**PCACA40503**

Title of the Course: **Big Data and Cloud Computing**

L-T-P: 3-1-2 Credits: 4

Prerequisite course / Knowledge (if any):

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

Course outcomes (COs)

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	--	--	--

PCACA40503: Big Data & Cloud Computing

Credits: 5 **IA: 40 Marks**

Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Defining Big Data, Evolution of Data Management, architectural foundation, The cycle of big data management, Waves of Managing Data, Defining Structured Data, Exploring sources of big structured data, the role of relational databases in big data, Unstructured Data.

Unit 2 **(15 hrs)**

Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Current Analytical Architecture, Data Analytics Lifecycle, Background and Overview of Data Analytics Lifecycle, Data Preparation, case study: google analytics.

Unit 3 **(15 hrs)**

Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure.

Unit 4 **(15 hrs)**

Virtualization, Introduction, Characteristics of Virtualized, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V. Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects.

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.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications

Course Code:PCACA40504
Title of the Course: Deep Learning
L-T-P: 3-1-2 Credits: 4

Prerequisite Course / Knowledge (If any):

- 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 (COs)

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)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**
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	--	--	--

PCACA40504: Deep Learning

Credits: 4 **IA: 50 Marks**
Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit 1 **(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 2 **(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 3 **(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 4 **(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: 0-3 14-93391 - 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.

PCACA40505: Mobile Computing and Network Security

Credits: 5 **IA: 50 Marks**

Contact Hrs (L:T:P): 6 (3:1:2) **End Exam: 75 Marks**

Unit – I **(15 hrs)**

Introduction: issues in mobile computing, overview of wireless telephony: cellular concept, GSM:air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit - II **(15 hrs)**

Wireless Networking: Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit-3 **(15 hrs)**

Introduction and Wireless Network Security: Introduction to Security in Networks, Characteristics of Networks, Intrusion, Kinds of security breaches, Plan of attack, Points of vulnerability, Methods of defense, Control measures, Effectiveness of controls, Wireless Network Security: Wireless Security, Mobile Device Security, Wireless LAN Overview, Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-To-End Security.

Unit-4 **(15 hrs)**

Security in Mobile And IoT: Security, Threats To SDN, NFV Security Attack Surfaces, ETSI Perspective, Cloud Security, Security Issues, Risks, Data Protection, Security As A Service, Addressing Cloud Security, IoT Security, Vulnerability Patching, Requirements By ITU-T, Security Framework.

References

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

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCAIC40400, PCARC40500**
Title of the Course: **Internship, Dissertation Evaluation and Viva voce**
L-T-P: 0+0+4=4 Credits: 5+2
Prerequisite Course / Knowledge (If any):

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

Course Outcomes (COs)

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

1 Create websites for school, PSU, Industries etc. (Level 6 Create)
2 Generate the documentation of project work. (Level 6 Create)
3 Develop a model that solves real time social issues. (Level 6 Create)
4 Develop the module and implement the concepts of computers. (Level 6 Create)
5 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)

Chairman
BoS in Computer Science