SEMESTER – IV

Discrete Mathematics
Code: PCC-CS401
Contacts: 3L

Name of the Course:	**Discrete Mathematics**	
Course Code: PCC-CS401	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial:		Assignment and Quiz : 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit
1	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well- Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	8

2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	5
3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proofby Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.	8
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	7
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi- connected component and Articulation Points, Shortest distances.	8

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
10. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures,

World Scientific, 1999.
11. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
12. N. Deo, Graph Theory, Prentice Hall of India, 1974.
13. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
14. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.
15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
19. S.B. Singh, Discrete Structures – Khanna Publishing House (AICTE Recommended Textbook – 2018)
20. S.B. Singh, Combinatorics and Graph Theory, Khanna Publishing House (AICTE Recommended Textbook – 2018)

Design and Analysis of Algorithms
Code: PCC-CS404
Contacts: 3L

Name of the Course:	**Design and Analysis of Algorithms**	
Course Code: PCC-CS404	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6
	Tractable and Intractable Problems: Computability	
4.	of Algorithms, Computability classes – P,NP, NP- complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4

Text books/ reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA
7. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018)
8. Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai

Biology
Code: BSC 401
Contacts: 2L

Name of the Course:	**Biology**	
Course Code: BSC-401	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 2hrs./week		Mid Semester exam: 15
Tutorial:		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	2	

Unit	Content	Hrs/Unit
1	To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	2
2	The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c)	3

	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus	
3	To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4
4.	Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.	4
5	Enzymes**:** To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4
6	Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA	4
	structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	

7	Macromolecular analysis**:** How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
8	Metabolism**:** The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of $K_{eq}$and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4
9	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3

Text books/ reference books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Environmental Sciences
Code: MC-401
Contacts: 2L

Name of the Course:	**Environmental Sciences**	
Course Code: MC-401	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:2hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	2	

Unit	Content	Hrs/Unit
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L) Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L) Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)	6

2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	6
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)	11

4.	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)	9
5	Lithosphere; Internal structure of earth, rock and soil (1L) Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)	3
6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, *L*10 (18hr Index) ,*n Ld*.Noise pollution control. (1L)	3
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	

Text books/ reference books:

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,1991.
3. De, A. K., "Environmental Chemistry", New Age International

Design & Analysis Algorithm Lab
Code: PCC-CS494
Contact: 4P

Name of the Course:	**Design & Analysis Algorithm Lab**
Course Code: PCC-CS494	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	
11	Implement Breadth First Search (BFS)
	Implement Depth First Search (DFS)

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Artificial Intelligence
Code: PCCAIML 401
Contacts: 3L

Name of the Course:	**Artificial Intelligence**	
Course Code**: PCCAIML 401**	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/ Unit
1	**Introduction [2]** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. **Intelligent Agents [2]** Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. **Problem Solving [2]** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6	
2.	**Search techniques [5]** Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. **Heuristic search strategies [5]** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. **Adversarial search [3**] Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	13	
3	**Knowledge & reasoning [3]** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	**3**	

4	**Using predicate logic [2]** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. **Probabilistic reasoning [4]** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	**6**	
5	**Natural Language processing [2]** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning [2]** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. **Expert Systems [2]** Representing and using domain knowledge, expert system shells, knowledge acquisition.	**6**	

Text book and Reference books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. M.C. Trivedi, Artificial Intelligence, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

OPTIMIZATION TECHNIQUES

Code: PCCAIML 402
Contacts: 3L

Name of the Course:	**OPTIMIZATION TECHNIQUE**
Course Code:PCCAIML402	Semester: IV
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Course Objectives

1.Use Matlab to implement important optimization methods.
2. Learn efficient computational procedures to solve optimization problems
3.Cast engineering minima/maxima problems into optimization framework.

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Historical Development, Engineering applications of optimization, Statement of an optimization problem, Classification of optimization problems	2	
2	Classical Optimization Techniques: Single variable optimization, Constrained and unconstrained multivariable optimization, Relevant applications	5	
3	Linear Programming: Standard form of a linear programming problem, Simplex method, Duality in linear programming, Quadratic programming, Stochastic linear programming, Relevant applications	6	
4	Nonlinear Programming: Unimodal function, Interpolation methods, Direct and indirect methods, Relevant applications	4	
5	Geometric Programming: Unconstrained and constrained geometric programming problems, Geometric programming with mixed inequality	5	
6	Integer Programming: Integer linear programming, Integer nonlinear programming, Relevant applications	4	
7	Game Theory: Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory,	2	

8	Genetic Algorithms: Introduction, Representation methods, Selection methods, Operators, Replacement methods, Relevant applications	2	

Text book and Reference books:

1. Rao, S. S., & Rao, S. S., Engineering optimization: theory and practice. John Wiley & Sons.
2. Hadley, G., Linear programming, Narosa Publishing house.
3. Taha, H. A., Operations research: An introduction. Pearson Education India.
4. Deb. K, Optimization for engineering design: Algorithms and examples. PHI Learning Pvt. Ltd.
5. Kumar, D. N., Multicriterion analysis in engineering and management. PHI Learning Pvt. Ltd.

Course Outcomes:

At the end of the course, students will be able to –

1. Relate key concepts and applications of various optimization techniques
2. Identify the appropriate optimization technique for the given problem
3. Formulate appropriate objective functions and constraints to solve real life optimization problem

Artificial Intelligence Lab
Code: PCCAIML 491
Contacts: 4P

Name of the Course:	Artificial Intelligence & Functional Programming Lab
Course Code: PCC-AIML491	Semester:IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
COURSE OBJECTIVES	
1. Gain a historical perspective of AI and its foundations.	
2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.	
3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	
4. Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool.	
5. Experiment with a machine learning model for simulation and analysis	

Unit 1
Prolog Representation: Introduction, Logic-Based Representation, Prolog Syntax, Creating, Changing, and Tracing a Prolog Computation, Lists and Recursion in Prolog.
Structured Representation and Inheritance Search: Abstract Data Types and Search, Using cut, Control Search in prolog, Abstract Data Types (ADTs) in Prolog.

Unit 2
1. Write a program to implementation of DFS
2. Write a program to implementation of BFS

Unit 3
1. Write a Program to find the solution for traveling salesman Problem
Unit 4
1. Write a program to implement Simulated Annealing Algorithm
2. Write a program to find the solution for wampus world problem
Unit 5
1. Write a program to implement 8 puzzle problem
Unit 6
1. Write a program to implement Tower of Hanoi problem
Unit 7
1. Write a program to implement A* Algorithm
Unit 8
1. Write a program to implement Hill Climbing Algorithm
Unit 9
1. To Study JESS expert system
Unit 10
1. To Study RVD expert system
Unit 11
1. Write a Program to Perform Fibonacci Series
2. Write a Program to Check Sides of a Triangle
Unit 12
1. Write a Program to Perform Length of List
2. Write a Program to Perform Reverse in List.
Unit 13
1. Write a Prolog program to perform Arithmetic Mean.
2. Write a Program to Check Vowels or Not.
Unit 14
Machine Learning Algorithms in Prolog: Machine Learning: Version Space Search, Explanation Based Learning in Prolog.
Programming in Lisp: S-Expressions, Syntax of LISP, Lists and Recursive Search, Variables, Datatypes, High Order Functions, Logic Programming in LISP, Lisp-Shell.
Unit 15
Semantic Networks, Inheritance and Machine Learning: Sematic Nets, Inheritance, Object Oriented Lisp, Learning ID3 Algorithm, And Implementing ID3 Algorithm.
Java, Representation and Object-Oriented Programming, Problem Spaces and Search, a Logic- Based Reasoning System, an Expert System Shell

Text books/ reference books:

Course Outcome

1) Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

2) Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

3) Demonstrate awareness and a fundamental understanding of various applications of AI

Techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

4) Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

5) Demonstrate proficiency in applying scientific method to models of machine learning.

PYTHON II / R Programming
Code: PCCAIML492
Contacts: 4P

Name of the Course:	**R Programming**	
Course Code:PCCAIML492	Semester: IV	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: 4 hrs./week		End Semester Exam : 70 Marks
Credit Points:	2	

Objective:	
1	identify and use available R packages and associated Open Source software to meet given scientific objectives
2	design and write efficient programs using R (and similar high-level languages) to perform routine and specialized data manipulation/management and analysis tasks
3	document analytical workflow using R, markdown languages, and version control
4	document, share, and collaborate on code development using a suite of Open Source standards and tools
Pre-Requisite:	
1	Computer Concepts and C Programming,
2	Database Management Systems

Practical Syllabus

1. Introduction to mechanism for statistics, data analysis, and machine learning; Introduction of R Programming, How to install and run R, Use of R help files, R Sessions, R Objects – Vectors, Attributes, Matrices, Array, Class, List, Data Frames etc. Operators in R.
2. R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, R Vector Function, Recursive Function in R.

3. R Packages (Install and Use), Input /Output Features in R, Reading or Writing in File. Data Manipulation in R. Rearranging data, Random Number and Simulation, Statistical methods like min, max, median, mean, length, Linear Regression, Normal Distribution,Decision tree
4. Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions – Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.

Text book and References.

1. Wickham, H. (2014) Advanced R. Chapman and Hall/CRC.
2. Hands-On Programming with R by Grolemund, O Reilly Publications
3. R for Everyone: Advanced Analytics and Graphics, 1e by Lander, Pearson Ltd.
4. R for Data Science Learning Dan Toomey December 2014 Packt Publishing Limited

Course Outcomes

1 Install and use R for simple programming tasks.
2 Extend the functionality of R by using add-on packages
3. Extract data from files and other sources and perform various data manipulation tasks on them.
4 Code statistical functions in R and apply data analytical techniques using R.

PYTHON II
Code: PCCAIML492
Contacts: 4P

Name of the Course:	**PYTHON II**	
Course Code:PCCAIML492	Semester: IV	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical:4 hrs./week		End Semester Exam : 70 Marks
Credit Points:	2	

Objective:	
1	To acquire programming skills in core Python
2	To acquire Object Oriented Skills in Python
3	To develop the skill of designing Graphical user Interfaces in Python
4	To develop the ability to write database applications in Python
Pre-Requisite:	
1	Computer Concepts and C Programming,
2	Database Management Systems

Practical Syllabus

Programming with Python-II

1. **Programs to read and write files.**
2. **Programs to perform exploratory data analysis, variance, standard deviation, summarization, distribution, statistical inference.**

3. **Plotting the various distribution for data set.**
4. **Write a program for K-mean clustering.**
5. **Program to demonstrate exception handling.**
6. **Program to demonstrate the use of regular expressions.**
7. **Program to show draw shapes & GUI controls.**
8. **Program to create server-client and exchange basic information.**
9. **Program to send email & read contents of URL.**
10. **Python with MySQL.**
11. **Python using linear regression, multiple regression and polynomial regression.**
12. **Python with MongoDB**
13.

Text book and Reference books:

Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016

Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010

Course Outcomes

1. Explain basic principles of Python programming language
2. Implement object oriented concepts
3. Implement database and GUI applications.