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| M.Sc., **ARTIFICIAL INTELLIGENCE** |
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| **SYLLABUS****FROM THE ACADEMIC YEAR****2023 - 2024** |
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| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION,**  **CHENNAI – 600 005** |
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| **TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION** |
| **Programme** | **M.Sc., ARTIFICIALINTELLIGENCE** |
| **Programme Code** |  |
| **Duration** | **PG - Two Years** |
| **Programme Outcomes (Pos)** | **PO1: Problem Solving Skill**Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.**PO2: Decision Making Skill**Foster analytical and critical thinking abilities for data-based decision-making.**PO3: Ethical Value**Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.**PO4: Communication Skill**Ability to develop communication, managerial and interpersonal skills.**PO5: Individual and Team Leadership Skill**Capability to lead themselves and the team to achieve organizational goals.**PO6: Employability Skill**Inculcate contemporary business practices to enhance employability skills in the competitive environment.**PO7: Entrepreneurial Skill**Equip with skills and competencies to become an entrepreneur.**PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society.**PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective.**PO 10: Moral and ethical awareness/reasoning**Ability to embrace moral/ethical values in conducting one’s life.  |
| **Programme Specific Outcomes****(PSOs)** | **PSO1 – Placement**To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.**PSO 2 - Entrepreneur**To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.**PSO3 – Research and Development**Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.**PSO4 – Contribution to Business World**To produce employable, ethical and innovative professionals to sustain in the dynamic business world.**PSO 5 – Contribution to the Society**To contribute to the development of the society by collaborating with stakeholders for mutual benefit. |

**Template for P.G., Programmes**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester–I** | **Credit** | **Hours** | **Semester-II** | **Credit** | **Hours** | **Semester-III** | **Credit** | **Hours** | **Semester–IV** | **Credit** | **Hours** |
| 1.1. Core-I  | 5 | 7 | 2.1. Core-IV  | 5 | 6 | 3.1. Core-VII | 5 | 6 | 4.1. Core-XI  | 5 | 6 |
| 1.2 Core-II  | 5 | 7 | 2.2 Core-V  | 5 | 6 | 3.2 Core-VII  | 5 | 6 | 4.2 Core-XII | 5 | 6 |
| 1.3 Core – III  | 4 | 6 | 2.3 Core – VI | 4 | 6 | 3.3 Core – IX | 5 | 6 | 4.3 Project with viva voce | 7 | 10 |
| 1.4 Discipline Centric Elective -I | 3 | 5 | 2.4 Discipline Centric Elective – III | 3 | 4 | 3.4 Core – X  | 4 | 6 | 4.4Elective - VI (Industry / Entrepreneurship) 20% Theory80% Practical  | 3 | 4 |
| 1.5 Generic Elective-II:  | 3 | 5 | 2.5 Generic Elective -IV:  | 3 | 4 | 3.5 Discipline Centric Elective - V  | 3 | 3 | 4.5 Skill Enhancement course / Professional Competency Skill  | 2 | 4 |
|  |  |  | 2.6 NME I | 2 | 4 | 3.6 NME II | 2 | 3 | 4.6 Extension Activity | 1 |  |
|  |  |  |  |  |  | 3.7 Internship/ Industrial Activity | 2 | - |  |  |  |
|  | **20** | **30** |  | **22** | **30** |  | **26** | **30** |  | **23** | **30** |
| **Total Credit Points -91** |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System**

**for all Post – Graduate Courses including Lab Hours**

**First Year – Semester – I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – I | 5 | 7 |
| Core – II | 5 | 7 |
| Core – III | 4 | 6 |
| Elective – I | 3 | 5 |
| Elective – II | 3 | 5 |
|  |  | **20** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – IV | 5 | 6 |
| Core – V | 5 | 6 |
| Core – VI | 4 | 6 |
| Elective – III | 3 | 4 |
| Elective – IV | 3 | 4 |
| Skill Enhancement Course [SEC] - I | 2 | 4 |
|  |  | **22** | **30** |

**Second Year – Semester – III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – VII | 5 | 6 |
| Core – VIII | 5 | 6 |
| Core – IX | 5 | 6 |
| Core (Industry Module) – X | 4 | 6 |
| Elective – V | 3 | 3 |
| Skill Enhancement Course - II | 2 | 3 |
|  | Internship / Industrial Activity | 2 | - |
|  |  | **26** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – XI | 5 | 6 |
| Core – XII | 5 | 6 |
| Project with VIVA VOCE | 7 | 10 |
| Elective – VI (Industry Entrepreneurship)  | 3 | 4 |
| Skill Enhancement Course – III / Professional Competency Skill | 2 | 4 |
| Extension Activity | 1 | - |
|  |  | **23** | **30** |

**Total 91 Credits for PG Courses**

|  |
| --- |
| **METHODS OF EVALUATION** |
| **Internal Evaluation** | Continuous Internal Assessment Test  | **25 Marks** |
| Assignments / Snap Test / Quiz |
| Seminars  |
| Attendance and Class Participation |
| **External Evaluation** | End Semester Examination | **75 Marks** |
| **Total** | **100 Marks** |
| **METHODS OF ASSESSMENT** |
| **Remembering (K1)** | * Thelowestlevelofquestionsrequirestudentstorecallinformationfromthecoursecontent
* Knowledgequestionsusuallyrequirestudentstoidentifyinformationinthetextbook.
 |
| **Understanding (K2)**  | * Understandingoffactsandideasbycomprehendingorganizing,comparing,translating,interpolatingandinterpretingintheirownwords.
* Thequestionsgobeyondsimplerecallandrequirestudentstocombinedatatogether
 |
| **Application (K3)** | * Studentshavetosolveproblemsbyusing/applyingaconceptlearnedintheclassroom.
* Studentsmust usetheir knowledgetodetermineaexactresponse.
 |
| **Analyze (K4)**  | * Analyzingthequestionisonethatasksthestudentstobreakdownsomethingintoitscomponentparts.
* Analyzingrequiresstudentstoidentifyreasonscausesormotivesandreachconclusionsorgeneralizations.
 |
| **Evaluate (K5)** | * Evaluationrequiresanindividualtomakejudgmentonsomething.
* Questionstobeaskedtojudgethevalueofanidea,acharacter,aworkofart,orasolutiontoaproblem.
* Studentsareengagedindecision-makingandproblem–solving.
* Evaluationquestionsdonothavesinglerightanswers.
 |
| **Create (K6)** | * Thequestionsofthiscategorychallengestudentstogetengagedincreativeandoriginalthinking.
* Developingoriginalideasandproblemsolvingskills
 |

**PROGRAMME OUTCOMES (PO) - PROGRAMME SPECIFIC OUTCOMES (PSO) MAPPING**

|  |
| --- |
| **PROGRAMME SPECIFIC OUTCOMES (PSO)** |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **PSO1** | **3** | **3** | **3** | **3** | **3** |
| **PSO2** | **3** | **3** | **3** | **3** | **3** |
| **PSO3** | **3** | **3** | **3** | **3** | **3** |
| **PSO4** | **3** | **3** | **3** | **3** | **3** |
| **PSO5** | **3** | **3** | **3** | **3** | **3** |

**Level of Correlation between PO’s and PSO’s**

*(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)*

Assign the value

**1 – Low**

**2 – Medium**

**3 – High**

**0 – No Correlation**

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| **M.Sc., ARTIFICIAL INTELLIGENCE** |
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**SEMESTER - I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course status** | **Course Title** | Credits | Hours |
| Core-1 | Artificial Intelligence & ExpertSystems | 5 | 7 |
| Core -2 | Design & Analysis of Algorithms | 5 | 7 |
| Core-3 | Python Programming | 4 | 6 |
| Elective - I  | Virtual Reality | 3 | 5 |
| Elective - II | Pattern Recognition & Image Analysis | 3 | 5 |
| Practical | Algorithm Lab using C++ |  |  |
| Practical | Python Programming Lab |  |  |
|  | **Total**  | **20** | **30** |

**SEMESTER - II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course status** | **Course Title** | Credits | Hours |
| Core 4 | Machine Learning | 5 | 6 |
| Core 5  | Artificial Neural Networks & Fuzzy Systems | 5 | 6 |
| Core 6 | Advanced Web Technology | 4 | 6 |
| Elective 3  | Compiler Design | 3 | 4 |
| Elective 4  | Distributed Operating Systems | 3 | 4 |
| Practical | Machine Learning Lab with Python/R& Hadoop |  |  |
| Practical | Advanced Web Technology Lab |  |  |
|  | Skill Enhancement Course [SEC] - INME  | 2 | 4 |
|  | Total  | 22 | 30 |

**SEMESTER - III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course status** | **Course Title** | Credits | Hours  |
| Core 7  | Natural Language Processing | 5 | 6 |
| Core 8  | Internet of Things | 5 | 6 |
| Core 9 | Optimization Techniques | 5 | 6 |
| Core 10 | Research Methodology | 4 | 6 |
| Elective 5 | Deep Learning/ Robotics | 3 | 3 |
| Practical | Natural Language Processing Lab |  |  |
|  | Skill Enhancement Course - II | 2 | 3 |
|  | Internship / Industrial Activity | 2 | - |
|  | **Total** | **26** | **30** |

**SEMESTER - IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course status** | **Course Title** | Credits | Hours  |
| Core 11 | Big Data Analytics | 5 | 6 |
| Core 12 | Mathematical Foundation forComputer Science | 5 | 6 |
|  | Project Work with Viva voce  | 7 | 10 |
| Elective 6 | Cryptography & Network Security | 3 | 4 |
|  | Skill Enhancement Course – III / Professional Competency Skill | 2 | 4 |
|  | Extension Activity | 1 | - |
|  | Total | **23** | **30** |

**Total Credits - 91**

**Semester -I**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Course No. | Course status | Course Title | Contact Hrs | Credits |
| 1 | Core 1 | ArtificialIntelligence&Expert Systems | 5 | 4 |
| 2 | Core 2 | Design&Analysisof algorithms | 5 | 4 |
| 3 | Core 3 | PythonProgramming | 4 | 4 |
| 4 | Core 4 | Big Data Analytics | 4 | 4 |
| 5 | Core 5 | MathematicalFoundationfor Computer Science | 4 | 4 |
| 6 | Core 6Practical1 | AlgorithmsLabusing C++ | 4 | 2 |
| 7 | Core 7Practical2 | PythonProgrammingLab | 4 | 2 |
|  |  | SubTotal | 30 | 24 |

**Core1**

**ARTIFICIALINTELLIGENCE&EXPERTSYSTEMS**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **1** | **0** | **4** |

***CourseObjectives:***

1. TounderstandthebasicconceptsandprinciplesofArtificialIntelligence
2. TolearnvariousapplicationsdomainsofAI
3. TostudytheconceptsofExpert Systems

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto

CO1.DelineateArtificialintelligence.

CO2.BuildknowledgeaboutExpertsystems.

CO3.Understandthebasicsofknowledgerepresentations CO4.Develop Expert Systems

CO5.DesignaFuzzysetforagivenapplication

**Unit-I FundamentalsofArtificialIntelligence 15hours**

Introduction, A. I.Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

**Unit-II SearchStrategies 15hours**

Uninformed Search: Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth FirstSearch, Bidirectional Search, Comparison of Uninformed search Strategies

Informed Search: Generate & test, Hill Climbing, Best First Search, A\* and AO\* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence

**Unit-III KnowledgeRepresentation 15hours**

Knowledge based agents, Wumpus world.Propositional Logic: Representation, Inference,ReasoningPatterns,Resolution,ForwardandBackwardChaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.Basics of PROLOG: Representation, Structure, Backtracking.

**Unit-IV NonMonotonicReasoning 15hours**

Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function, designing a fuzzy setfor a given application.Probability and Bayes’ theorem - Bayesian Networks.

**Unit-VExpertsystems 15hours**

Architecture of expert systems, Role of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics.Typical expert systems – MYCIN, PROSPECTOR

**CO-PO -PSOMapping**

|  |
| --- |
| **ARTIFICIALINTELLIGENCE&EXPERTSYSTEMS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Text Books:**

1. ElaineRich,KevinKnight,ShivashankarB.Nair,"ArtificialIntelligence."Tata McGraw Hill, 3rdEdition
2. StuartRussell&PeterNorvig:"ArtificialIntelligence:AModernApproach", Pearson Education, 2ndEdition.
3. DonaldA.Waterman:“AGuidetoExpertSystems”,AddisonWesleyPublishing Company

**Reference Books:**

1. IvanBratko,"PrologProgrammingForArtificialIntelligence",2ndEdition Addison Wesley
2. Eugene,Charniak,DrewMcDermott,"IntroductiontoArtificialIntelligence", Addison Wesley
3. Patterson,“IntroductiontoAIandExpertSystems”,PHI
4. Nilsson,“PrinciplesofArtificialIntelligence”,Morgan Kaufmann.
5. CarlTownsend,“IntroductiontoTurboProlog”

**Core2**

**DESIGNANDANALYSISOF ALGORITHMS**

***CourseObjectives:***

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **1** | **0** | **4** |

* 1. TounderstandfundamentalconceptsofAlgorithm
	2. ToimpartknowledgeaboutBasicTraversalAndSearchTechniquesand Problematic Design
	3. Toimplementthelinearandnon-lineardata structures

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Understand and solve complex problems

CO2.Selectanappropriatealgorithmfortheproblem

CO3.Evolveasacompetentprogrammercapableofdesigningandanalyzing algorithms and data structures for different kinds of problems

CO4.ClassifyproblemsintocomplexityclasseslikePandNP. CO5.Analyzegraphs and determine shortest path

**UNIT-1 15hours**

Introduction: Algorithm-Specification - Performance Analysis.Divide AndConquer - General Method - Binary Search - Find the Maximum and Minimum - Quick sort - Strassen’s Matrix Multiplication.

**Unit–II 15hours**

Representingrooted trees –Hash Tables: Direct-addresstables,Hashtables,Hash functions - Open addressing, Perfect hashing – Binary Search Trees: Querying a binary search tree, Insertion and deletion, Randomly built binary search trees – Red-Black Trees: Properties of red-black trees, Rotations, Insertion, Deletion – B- Trees: Definition of B-trees, Basic operations, Deleting a key from a B-tree.

**UNIT– III 15hours**

The Greedy Method: General Method - Knapsack Problem - Job Sequencing with Deadlines- Minimum Cost Spanning Tree - Single Source Shortest Path.Dynamic Programming:GeneralMethod-MultistageGraph-AllPairsShortestPath -Optimal Binary Search Tree - 0/1 Knapsack- Travelling Salesperson Problem.

**UNIT– IV 15hours**

Basic Traversal And Search Techniques: Techniques for Binary Trees –Techniques for Graphs-Connected Components and Spanning Trees-Bi-connected Components and DFS.Backtracking: General Method-8-Queen Problem, Sum of Subsets Graph Coloring: Hamiltonian Cycle.

**UNIT– V 15hours**

Graph Algorithms: Representation of Graphs, Breadth first search, Depth first search, Topological sort.Minimum Spanning Trees: Algorithms of Kruskal and Prim – Single Source Shortest Path: The Bellman-Ford Algorithm, Single source shortestpathindirectedacyclicgraphs,Dijkstra’salgorithmAllpairsShortest

Path: Shortest path and Matrix Multiplication, The Floyd-Warshall algorithm – Johnson’s algorithm for sparse graphs.

**CO-PO -PSOMapping**

|  |
| --- |
| **DESIGNANDANALYSISOF ALGORITHMS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **M** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **M** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO5** | **S** | **S** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

***TextandReferencebooks***

1. Ellis Horowitz, Sartaj Sahni and SanguthevarRajasekaran, “Fundamentals of Computer Algorithms”, 2nd Edition, Universities Press(India) Private Ltd.,2018.
2. Aho, Hoporoft and Ullman, “The Design and Analysis of Computer Algorithm”, Pearson Education, Delhi, 2001.
3. BasuS.K.,“DesignMethodsandAnalysisofAlgorithms”,PHI, 2006.
4. M. A. Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education,Asia, 2013.
5. Sandeep Sen and Amit Kumar, “Design and Analysis of Algorithms: A contemporaryperspective”, Cambridge University Press, 2019.
6. Thomas S.Cormen, Charles E.Liersorson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, The MIT Press, Cambridge, Massachusetts, London, England.
7. Eric Bach and Jeffrey Shallit, “Algorithmic Number Theory: Efficient Algorithms”,VolI:TheMITPress,Cambridge,Massachusetts,London,

England.

**Core3**

***CourseObjectives:***

**PYTHONPROGRAMMING**

* 1. TounderstanddifferentdatatypesinPython

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **4** |

* 1. TolearnthedifferentconceptsinPython
	2. ToanalyzeDatabase ConnectivityandDataVisualization

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto

CO1.CreateArrays,Strings,ListsandTuples

CO2.ExamineDictionaries&ObjectOrientedProgrammingconceptsinPython. CO3.Understand Database Connectivity and Data Visualization

CO4.AccessDatabasewithPython CO5.Use MySQL from Python

**UNIT I INTRODUCTION 12hours**

Introduction to Python: Features of Python – Writing the First Python Program – Executing a Python Program – Datatypes in Python – Literals – Operators – Input and Output – Control Statements.

**UNIT II ARRAYS,STRINGS,FUNCTIONSANDTUPLES 12hours**

Creating an Array – Indexing and Slicing on Arrays – Types of Arrays – Working with arrays using numpy- Slicing and Indexing in numpy Arrays – Working with Multi-dimensional Arrays – Indexing and Slicing the Multi-dimensional Arrays – Creating Strings – Indexing, Slicing and Comparing Strings – Finding and Counting Substrings – Splitting and Joining Strings – Defining and Calling a Function–Passby ObjectReference –AnonymousFunctionsorLambdas–Lists – Creating and Updating the Elements of a List – Methods to Process Lists –Creating Tuples – Functions to process Tuples – Inserting, Modifying and Deleting Elements from a Tuple.

**UNIT III DICTIONARIESANDINTRODUCTIONTOOOPS 12hours**

Operations on Dictionaries – Dictionary Methods – Creating a Class – Types of Variables – Types of Methods – Constructors in Inheritance – Types of Inheritance – Operator Overloading – Method Overloading and Overriding – Interfaces in Python – Regular Expressions in Python.

**UNIT IV DATASTUCTURES&GUI 12hours**

Linked Lists – Stacks – Queues – **Graphical User Interface:** The Root Window – Working with Containers – Canvas – Frame – Widgets – Button Widget – Label Widget – Message Widget – Text Widget – Scrollbar Widget – Checkbutton Widget – Radiobutton Widget – Entry Widget – Listbox Widget – Menu Widget – Creating Tables – Sending a Simple Mail.

**UNIT V DATABASECONNECTIVITY& DATA SCIENCE 12hours**

Database Connectivity: Types of Databases used with Python – Using MySQL from Python – Retrieving all rows from a Table – Inserting, Deleting and Updating rows in a Table – Creating Database Tables using Python

DataScienceusingPython**:**DataFrameandData Visualization.

**CO-PO -PSOMapping**

|  |
| --- |
| **PYTHONPROGRAMMING** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TEXT BOOK**

Dr.R.Nageswara Rao, “Core Python Programming”, Second Edition, Dreamtech Press, 2019.

**REFERENCE BOOKS**

1. MartinC. Brown,“TheCompleteReferencePython”,IndianEdition,Mc Graw Hill Education, 2018.
2. YashavantKanetkar,AdityaKanetkar,“LetusPython”,SecondEdition,BPB Publications, 2019.

**Core4**

***CourseObjectives:***

**BIGDATAANALYTICS**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **4** |

1. Tounderstandthefundamentalconceptsofbigdata and analytics.
2. Toexploretoolsand practicesforworkingwithbigdata
3. Toknowabouttheresearchwiththeintegrationoflargeamountsofdata.

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1.Acquire the knowledge on the basics of Big Data

CO2.Workwithbigdata tools

CO3.Design efficient algorithms for mining the data from large volumes CO4.Explorethecutting-edgetoolsandtechnologiestoanalyzeBigData

CO5.AppreciateBigDataProcessingconceptsandDatavisualization techniques

**UNIT-1 INTRODUCTION 12hours**

IntroductiontoBigDataAnalytics:Big DataOverview–DataStructures–Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize.

**UNIT–IIDATAANALYTIC METHODS 12hours**

Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interfaces – Data Import and Export Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation -– Statistical Methods of Evaluation: Hypothesis Testing – Difference of Means – Wilcoxon Rank-Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA.

**UNIT–IIIADVANCED METHODS 12hours**

Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics Reasons to choose and cautions – Additional Algorithms - Association Rules: A Priori Algorithm – Evaluation of Candidate Rules Applications of Association Rules – Validation and Testing – Diagnostics.Regression: Linear Regression and Logistic Regression: – Use cases – Model Description – Diagnostics - Additional Regression Models.

**UNIT– IVCLASSIFICATION 12hours**

Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Naive Bayes – Bayes Theorem – Naïve Bayes Classifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis:Overview –Box–JenkinsMethodology–ARIMAModel –Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models–BuildingandEvaluatingandARIMAModel-TextAnalysis:TextAnalysis

Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights.

**UNIT– VTECHNOLOGY 12hours**

Advanced Analytics-Technology and Tools: MapReduce and Hadoop: Analytics for Unstructured Data . - Use Cases - MapReduce - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Mahout – NoSQL - Tools in Database Analytics : SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates- MADLib – Analytics Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data - Model details – Recommendations – Data Visualization

**CO-PO -PSOMapping**

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| **BIGDATAANALYTICS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **M** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO5** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

***Textbooks***

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and PresentingData”,EMCEducationServicesPublishedbyJohnWiley&Sons,
2. NoreenBurlingame,“Thelittlebook onBigData”,NewStreetpublishers,2012.
3. AnilMaheshwari,“DataAnalytics”,McGrawHillEducation,2017.

***Reference books***

1. DavidLoshin,"BigDataAnalytics:FromStrategicPlanningtoEnterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2. BartBaesens,"AnalyticsinaBigDataWorld:TheEssentialGuidetoData Science and its Applications", Wiley Publishers, 2015.
3. DietmarJannachandMarkusZanker,"RecommenderSystems:An Introduction", Cambridge University Press, 2010.
4. KimS.PriesandRobertDunnigan,"BigDataAnalytics:APracticalGuidefor Managers " CRC Press, 2015.

**Core5 MATHEMATICALFOUNDATIONFORCOMPUTERSCIENCE**

***CourseObjectives:***

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* 1. TounderstandthebasicconceptsofSetTheoryand Graph Theory
	2. Toanalyseusingcorrelationand regression
	3. Toworkwithmatrices

***CourseOutcome:***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Acquireknowledgeofrelations,functionsandmathematicallogic CO2. Statistically analyse data

CO3.Analyzecorrelationbetween data

CO4.Computesolutionsoflinearequationsandsystemofequations CO5. Understand the basic concepts of Graph Theory

**UNIT I SETTHEORY 12hours**

Basic concepts of set theory: Notation – Inclusion of equality of sets – Power set – Operation on sets – Venn diagrams

Relations and ordering: Cartesian products - Relations – Properties of Binary Relation in a set – Relation matrix and graph – Equivalence relations – Composition of Binary Relations.

Functions: Definition and Introduction – Composition of functions – Inverse function.

**UNIT II MATRICES 12hours**

Introduction – Vectors – Methods of Testing Linear Dependence – Consistency of a SystemofLinearAlgebraicEquation –RankoftheMatrix –InverseoftheMatrix- Eigen Values and Eigen Vectors – Cayley Hamilton Theorem.

**UNIT III GRAPH THEORY 12hours**

Basic terminology: Different types of graphs – Directed and Undirected – Simple – Pseudo – Complete – Regular – Bipartite – Incidence and Degree – Pendant and Isolated Vertex – Null Graph – Isomorphism – Sub Graphs – Walk – Path and Circuit – Connected and Disconnected Graphs and Components - Planar graphs, Euler's formula - Operations on Graphs – Matrix representation of Graphs – Incidence Matrix – Path matrix -Adjacency Matrix

**UNIT IV STATISTICS 12hours**

Measure of Central Tendency (Arithmetic Mean, Median, Mode); Measure of Dispersion (Absolute and Relative Measures Range, Quartile Deviation, Mean Deviation, Standard Deviation and Coefficient of Variation)

Correlation:Definition, Scatter diagram, Karl Pearson's coefficient of correlation, Numerical problems for determination of Correlation Coefficients.

**UNITVNUMERICALMETHODS 12hours**

Basics – Errors- Significant Digits – Solving Simultaneous Linear Equations – Bisection Method -Regula Falsi Method – Newton Raphson Method – Gauss Elimination Method – Gauss Jordan Method – Jacobi Iteration Method – Gauss Seidal Method

**CO-PO -PSOMapping**

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| **MATHEMATICALFOUNDATIONFORCOMPUTERSCIENCE** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **M** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **K-3** |
| **CO3** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TEXTBOOKS**

1. J. P Trembley, R. Manohar, “Discrete Mathematical structures with applications to Computer Science”, Tata McGrawHill publications, 2017.
2. SeymourLipschutz,MarcLipson,“DiscreteMathematics”,RevisedThirdEdition, Schaum’s Outline Series, Tata McGraw Hill Publications, 2002.
3. B.S. Grewal,"NumericalmethodsinEngineering&Science",Khanna Publishers, Fifth Edition, April 2018.

**Note:Excludingalgorithmsandtheorems. REFERENCE BOOKS**

1. S.Santha, “DiscreteMathematics with Combinatory and Graph Theory”, Third Edition, Cengage Publications, 2015.
2. S. Arumugam,A.ThangapandiIsaac,"Statistics",NewGammaPublishing House, 2018.
3. SCGupta,“FundamentalsofStatistics”,HimalayaPublishingHouse

**Core6Practical1**

**ALGORITHMLABUSINGC++**

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***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Understand and solve complex problems

CO2.Selectanappropriatealgorithmfortheproblem

CO3.Evolveasacompetentprogrammercapableofdesigningandanalyzing algorithms and data structures for different kinds of problems

CO4.EvaluatePostfixexpressions

CO5.Analyzeandfindshortestpathina graph

**PracticalList**

1. ImplementMergeSort,HeapSortandQuickSort algorithms.
2. Implementtheknapsackproblem(0/1).
3. Obtainthetopologicalorderingofverticesinagivendigraph
4. Greedy algorithm to find minimum number of coins to make change for a given value of Indian currency.Assume that we have infinite supply of denominations in Indian currency.
5. ImplementBreadthFirstSearchandDepthFirst search
6. UsePrim’sAlgorithmtofindaminimumspanningtree.
7. FindshortestpathusingDijkstra’s algorithm.
8. Multiply two matrices recursively.
9. Findwhetherastringisapermutationofanothergiven string.
10. Postfixevaluation
11. Binary tree traversal
12. BinarySearchTree
13. Nqueen problem
14. Hash table
15. Divideandconqueralgorithmforbinarysearch

**CO-PO -PSOMapping**

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| **ALGORITHMLABUSINGC++** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Core7Practical2**

***CourseOutcome:***

**PYTHONPROGRAMMINGLAB**

Onsuccessfulcompletionofthecourse,thelearnerswillbe able to

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CO1.AppreciateprogrammingconceptsinPython CO2. Work with Widgets.

CO3.Insert,DeleteandUpdateinDatabase.

CO4.CreateandperformoperationsusingDataFrames. CO5. Implement Data Visualization

**PracticalList**

* 1. ProgramtogeneratetheFibonacciSeries.
	2. Programtocheckwhetherthegivennumberisprimeornot.
	3. Programtofindthefactorialofagivennumberusing function.
	4. Program using Arrays -Python program to sort the elements of an array in ascending order
	5. ProgramusingStrings-ProgramtoSortWordsinAlphabeticOrder
	6. Programtoperformvariouslistoperations,suchas:
		+ Appendanelement
		+ Insertanelement
		+ Appendalisttothegivenlist
		+ Modifyan existing element
		+ Deletean existing element from its position
		+ Deleteanexistingelement withagiven value
		+ Sortthelist
		+ Display the list.
	7. ProgramusingTuples-Writeaprogramtoswaptwonumberswithout using a temporary variable.
	8. Program using Dictionaries - Write a program to count the number of times a character appears in a given string
	9. Writeafunctiontoconvertnumberintocorrespondingnumberinwords Foreg, if the input is 876 then the output should be ‘Eight Seven Six’.
	10. ProgramusingInheritance.
	11. ProgramusingInterfaces.
	12. ProgramusingRegularExpressions.
	13. ProgramtoperformStackOperations.
	14. ProgramtoperformQueueOperations.
	15. Working with Widgets.
	16. ProgramtoInsert,DeleteandUpdatein Database.
	17. ProgramtocreateandperformoperationsusingDataFrames.
	18. ProgramtoimplementDataVisualization.

**CO-PO -PSOMapping**

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| **PYTHONPROGRAMMINGLAB** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-6** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**SemesterII**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Course No. | Course status | Course Title | Contact Hrs | Credits |
| 8 | Core 8 | Machine Learning | 5 | 4 |
| 9 | Core 9 | ArtificialNeuralNetworks& Fuzzy Systems | 5 | 4 |
| 10 | Core 10 | AdvancedWebTechnology | 4 | 4 |
| 11 | Core 11 | CompilerDesign | 4 | 4 |
| 12 | Elective1 | DistributedOperatingSystems/ Virtual Reality/ Pattern Recognition & Image Analysis | 4 | 3 |
| 13 | Core12Practical3 | MachineLearninglabwith Python/ R & Hadoop | 4 | 2 |
| 14 | Core13Practical4 | AdvancedWebTechnology Lab | 4 | 2 |
| SubTotal | 30 | 23 |

**Core8**

[C L

***CourseObjectives:***

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**MACHINELEARNING**

1. TounderstandtheconceptofMachineIntelligence
2. Toimplementandapplymachinelearningalgorithmstoreal-world applications.
3. To identify and apply the appropriate machine learning technique to classification,patternrecognition,optimizationanddecisionproblems.

***CourseOutcomes***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Haveagoodunderstandingofthefundamentalissuesandchallengesof Machine learning

CO2.Appreciatetheunderlyingmathematicalrelationshipswithinandacross Machine Learningalgorithms

CO3.Understandtheparadigmsofsupervisedandun-supervisedlearning. CO4. Design and implement various machine learning applications

CO5.Analyzedifferentmachinelearningmodels

**UNIT-1INTRODUCTION 15hours**

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Linear Discriminants – Perceptron – Linear Separability– Linear Regression.

**UNIT-IILINEARMODELS 15hours**

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi- layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Course ofDimensionality – Interpolations and Basis Functions – Support Vector Machines

**UNIT–IIITREEANDPROBABILISTICMODELS 15hours**

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

**UNIT-IVDIMENSIONALITYREDUCTIONANDEVOLUTIONARYMODELS 15**

**hours**

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

**UNIT–VGRAPHICAL MODELS 15hours**

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

**CO-PO -PSOMapping**

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| **MACHINELEARNING** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **M** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO3** | **S** | **S** | **S** | **S** | **S** | **S** | **M** | **S** | **S** | **N** | **K-4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-6** |
| **CO5** | **M** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

***Textbooks***

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition,ChapmanandHall/CRCMachineLearningandPatternRecognition Series, 2014.
2. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013.

**Core9 FUZZYLOGICANDNEURALNETWORK**

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| **L** | **T** | **P** | **C** |
| **4** | **1** | **0** | **4** |

***CourseObjectives:***

* 1. TounderstandtheconceptofFuzzyLogic
	2. Toanalyzethearchitectureandworkingofneuralnetwork

***CourseOutcome:***

On successful completion of the course, the learners will be able to CO1.GainsoundknowledgeofFuzzyLogicandNeuralNetworks CO2. Apply fuzzy logic and reasoning to handle uncertainty

CO3.ApplyNeuralNetworkbasedalgorithmstorealworldproblems CO4. Analyze Neuro-fuzzy system

CO5.UnderstandFuzzySystemArchitecture

**UNITIFUNDAMENTALSOFFUZZYLOGIC 15hours**

Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements- union intersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems

**UNITIIARCHITECTUREOFNEURAL NETWORKS 15hours**

Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture- setting weights-common activations functions Basic learning rules- Mcculloch- Pitts neuron- Architecture, algorithm, applications-single layer net for pattern classification- Biases and thresholds, linear separability - Hebb’s rule- algorithm - perceptron - Convergence theorem-Delta rule

**UNITIIIBASICNEURALNETWORKTECHNIQUES 15hours**

Back propagation neural net: standard back propagation-architecture algorithm- derivation of learning rules number of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine

**UNITIV COMPETITIVENEURALNETWORKS 15hours**

Neuralnetworkbasedoncompetition:fixedweightcompetitivenets-Kohonenself- organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2

**UNITVSPECIALNEURALNETWORKS 15hours**

Cognitron and Neocognitron - Architecture, training algorithm and application- fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems.

**CO-PO -PSOMapping**

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| **FUZZYLOGICANDNEURALNETWORK** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO5** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **M** | **S** | **S** | **K– 4** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Text books:**

1. T.Kliryvan-FuzzySystem&FuzzylogicPrenticeHallofIndia,FirstEdition.
2. LawrenceFussett-FundamentalofNeuralNetworkPrenticeHall,FirstEdition.

**Reference Books:**

1. BartKosko,―NeuralnetworkandFuzzySystem‖-PrenticeHall-1994.
2. J.KlinandT.A. Folger,―Fuzzysets‖Universityandinformation-PrenticeHall

-1996.

1. J.M.Zurada,―Introductiontoartificialneuralsystems‖-JaicoPublication house,Delhi 1994.
2. VallusuRaoandHayagvnaRao,―C++Neuralnetworkandfuzzylogic‖-BPBand Publication, New Delhi,1996.
3. IntelligentSystemsandControl-[http://nptel.](http://nptel/)ac.in/courses/108104049/16

**Core10**

**ADVANCEDWEBTECHNOLOGY**

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***CourseObjectives:***

* 1. Explorethebackboneofwebpagecreation
	2. EnrichknowledgeaboutHTMLcontrolandwebcontrol classes
	3. ProvidedepthknowledgeaboutJavaScrit,PHP,MySQLandAJAX
	4. Understandtheneedofusability,evaluationmethodsforweb services

***CourseOutcome***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.DesignawebpagewithWebformfundamentalsandwebcontrolclasses CO2. Recognize the importance of validation control, cookies and session

CO3.ApplytheknowledgeofJavaScriptobject,dataaccessandSQLto develop a client servermodel.

CO4. Gain in- depth knowledge of Java Script, PHP, MySQL and AJAX CO5.Analyzetheneedofusability,evaluationmethodsforwebservices

**UNIT 1: Web Technologies and HTML 12 hours** Internet and web Technologies - Client/Server model- Web Search Engine - Web Crawling-WebIndexing-SearchEngineOptimizationandLimitations-Web Services–CollectiveIntelligence–MobileWeb–FeaturesofWeb3.0-HTMLvs HTML5 - Exploring Editors and Browsers Supported by HTML5 - New Elements - HTML5Semantics-MigrationfromHTMLtoHTML5-Canvas-HTMLMedia- HTMLGeolocation-IntroductiontoCSS3-CSS2vsCSS3-RoundedCorner- BorderImages-MultiBackground-Gradients-iframe-2dand3dtransform- Animation.

**UNIT2:XMLandAJAX 12hours**

XML - Documents and Vocabularies-Versions and Declaration -Namespaces JavaScriptandXML: Ajax - DOM based XML processing Event - oriented Parsing: SAX - Transforming XML Documents-Selecting XML Data : XPATH-TemplatebasedTransformations:XSLT-Displaying XMLDocuments inBrowsers-Evolution of AJAX -Web applications with AJAX -AJAXFramework.

**UNIT 3:Client Side Scripting with Java Script 12 hours** JavaScriptImplementation-UseJavascripttointeractwithsomeofthenewHTML5 apis -Createand modify Javascript objects - JS Forms - Events and Event handling-JSNavigator-JSCookies-IntroductiontoJSON-JSONvsXML- JSON Parse-JSON Objects-jQuerySelectors-jQueryHTML&CSS-jQueryDOM

-ImportanceofAngularJSinweb-AngularExpressionandDirectives- AngularJS Data Binding and Controllers - Filters.

**UNIT4:ServersideScriptingwithPHP 12hours**

EssentialsofPHP- InstallationofWebServer,XAMPPConfigurations-PHPForms

-GETandPOSTmethod-URLencoding-HTMLEncoding-RegularExpressions

- Cookies - Sessions -Usage of Include and require statements - File:read and write from the file - PHP Filters - PHP XML Parser - Introduction to Node. js -Node. js Modules and filesystem - Node. js Events.

**UNIT5:MySQLandMEAN STACK 12hours**

PHP with MySQL - Performing basic database operation(DML) (Insert, Delete, Update, Select) - Prepared Statement - Uploading Image or File to MySQL - Retrieve Image or File from MySQL

Uploading Multiple Files to MySQL – SQLInjection - Introduction to MEAN and Express. JS -Real time example for modern web applications using MEAN

**CO-PO -PSOMapping**

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| **ADVANCEDWEBTECHNOLOGY** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K– 1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Text Books**

1. Paul Deitel,Harvey Deitel&Abbey Deitel,Internet and World Wide Web: How to Program,Pearson Education, Fifth edition, 2018
2. AmosQ.Haviv,MEANWebDevelopment,PacktPublishing,SecondEdition, 2016

**Reference Books**

1. LauraLemay,Rafe Colburn&Jennifer Kyrnin,MasteringHTML, CSS &JavascriptWebPublishing, BPB Publications, First edition, 2016
2. AlexGiamas,MasteringMongoDB3.x,PacktPublishingLimited,First Edition, 2017

**Core11**

**COMPILERDESIGN**

***CourseObjectives:***

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **4** |

1. Tounderstandtheprinciplesusedtoconstructvariousphasesofa compiler.
2. Toexploreknowledgeaboutparsers

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Understand various phases of a compiler

CO2.Appreciatetheworkingofaparser

CO3.Explorethefeaturesofcodegenerationandoptimizationtechniques CO4. Use Optimization Techniques

CO5.Designa compiler

**UNIT-ILEXICALANALYSIS 12hours**

Introduction to Compiling: Language Processors, The Structure of a Compiler. Lexical Analysis: The role of the lexical analyzer - Input buffering Specification of tokens - Recognition of tokens – The Lexical Analyzer Generator Lex - Finite automata - Regular expression to finite automata – Design of Lexical Analyzer Generator - Optimization of DFA - based pattern matchers.

**UNIT–IISYNTAXANALYSIS 12hours**

Syntax Analysis: The role of the parser - Context-free grammars - Writing a grammar-Top downParsing-Bottom-upParsing-LRparsers-ParserGenerators. Run time environment: Storage Organization – Static Allocation of space.

**UNIT–IIIINTERMEDIATECODE GENERATION 12hours**

Intermediate Code Generation : Variants of Syntax trees – Three Address code – Types and Declarations - Translation of Expressions – Type checking - Controlflow - Back patching - Switch Statements – Intermediate Code for Procedure

**UNIT–IVCODE GENERATION 12hours**

Code Generation : Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs – Optimization of Basic Blocks - A simple code generator – Peephole Optimization.

**UNIT– V OPTIMIZATIONTECHNIQUES 12hours**

Machine Independent Optimizations: The Principal Sources ofOptimization - IntroductiontoDataFlowanalysis–Foundationsofdataflowanalysis–Partial RedundancyElimination - Loops in flow graph

**CO-PO -PSOMapping**

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| **COMPILERDESIGN** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K– 1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**Text Book**

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

AlfredV.Aho,MonicaS. Lam,RaviSethiandJeffreyD.Ullman,“Compilers- Principles,Techniques,andTools”,SecondEdition,PearsonEducationAsia,2014.

**Reference Books**

1. Kennath C.Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
2. Terence Halsey, Compiler Design Principles, Techniques and Tools, Larsen andKeller Education, 2018
3. SudhaRaniS,KarthiM.,RajKumarY-CompilerDesign,Wiley2019.
4. AdeshKPandey,“ConceptsofCompilerDesign”,Katson,2013.

**Elective1A**

**DISTRIBUTEDOPERATINGSYSTEMS**

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| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **3** |

***CourseObjectives:***

* 1. Togetaclearunderstandingaboutnetworksandoperatingsystems
	2. Toapplybasicnetworkingconceptsin projects
	3. Togetclearunderstandingaboutfilesystems

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Get an insight about networking concepts

CO2.Gainknowledgeaboutoperatingsystemconcepts CO3. Understand file system concepts

CO4.AnalyzeDeadlock

CO5.ExploreProcessmanagement

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| --- | --- | --- | --- | --- | --- | --- |
| **UNIT-1** |  |  |  |  | **12 hours** |  |
| Fundamentals: | What | is | Distributed | Operating | System | – Evolution | of |

DistributedComputingSystem–DistributedComputingSystemModels–Whyare Distributed Computing Systems gaining popularity – What is a Distributed Computing System – Issues in Designing Distributed Computing System – Introduction to Distributed Computing Environment.Introduction to Computer Networks – Network types – LAN –WAN – Communication protocols – Internetworking – ATM Technology

**UNIT– II 12hours**

Message Passing: Introduction Desirable features – Issues in PC Message Passing– Synchronization – Buffering – Multi datagram Messages – Encoding and Decoding – Process Addressing – Failure Handling – Group Communication

**UNIT– III 12hours**

Remote Procedure Calls : RPC models – Transparency of RPC–Stub generation– RPC messages– Marshaling arguments and results–Exception Handling–Light weight RPC; Distributed Shared Memory: Introduction – General Architecture of DSM system – Design and Implementation Issues of DSM – Granularity – Structure of Shared Memory – Consistency Models – Replacement Strategy – Thrashing.

**UNIT– IV 12hours**

Synchronization:Introduction–ClockSynchronization–EventOrdering– Mutual Exclusion – Deadlock – Election Algorithm– Process Management: Introduction-Process Migration– Threads.

**UNIT– V 12hours**

Distributed File System: Introduction – Desirable features – File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes – File Replication – Fault Tolerance – AtomicTransactions – Design Principles.

**CO-PO -PSOMapping**

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| **DISTRIBUTEDOPERATINGSYSTEMS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-3** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**Text books**

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

1. Pradeep K Sinha, ―Distributed Operating Systems – Concepts and Design‖, PHI,2016
2. AndrewSTanenbaum,―DistributedOperatingSystems,FirstEdition,PHI. 2017

ReferenceBooks

* 1. AbrahamSilberschatz,PeterB. GalvinG. Gagne, OperatingSystems Concepts, Ninth edition, Addision Wesley Publishing Co., 2018.
	2. Coulouris George, Dollimore Jean, Blair Gordon–Distributed systems- concepts and design Pearson 2017.

**Elective1B**

***CourseObjectives:***

**VIRTUALREALITY**

* + 1. Tounderstandthebasicsoftypography,gridsinlayoutdesign,color modes

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* + 1. ToconceivethedesignconceptsofVirtual Reality

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Work with typography and grids in layout design

CO2.Efficientlyusevariouscolor modes

CO3.Abletorecordanactionandcreaterolloverstates CO4. Explore the issues in Virtual Reality

CO5.AnalyzetheroleandimportanceofVirtualRealityinthemodernworld.

**UNIT I 12hours**

Basic elements of visual design - Principles of visual design - Creating - Headlines and Body content - Pre-press technology and Post-press technology Grids inlayout design: Anatomy of a grid - Types of layout design - Mixed design - Design process-BrandManagement-Branding-Brandidentitydesign-Designthinking process

**UNIT II 12hours**

Introduction–AgenericVRsystem:Virtualenvironment–Technology–Modesof Interaction – VR Hardware: Sensor Hardware, Head Coupled displays – Acoustic hardware – Integrated VR – VR Software: Modeling Virtual worlds – Physical simulations – VR Applications

**UNIT III 12hours**

Designing for VR -Visual aid - UI depth and eye strain - Constant velocity - Maintainingheadtracking-Guidingwithlight-Leveragingscale-Spatialaudio- Gaze Cues Image Size and resolution - Pixel density - Eye buffers - Optimal resolution- Creating Panoramic Images

**UNIT IV 12hours**

Color Modes: Changing color mode - Type tool options - Work path from type - Layerspanel-Typesoflayers-Featuresoflayers-ShapetoolsandPaintingTools

-Brushtools-Gradienttools-Effectspanel -Graphicspanel-Photo effects

**UNIT V 12hours**

Filter Gallery: Applying filters - Smart filters - Channels panel - Actions panel - Change settings - Exclude commands - Inserting a non-recordable menu command-Batchcommand-Rollovers-Creatingbuttons-Makelayerduplicates

-Createrolloverstates360-degreeillustrationsforVR-Panorama-Planningand drawing 360-degree illustration - Exporting for VR 23

**CO-PO -PSOMapping**

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| **VIRTUALREALITY** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-6** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Text Books:**

1. JohnVince,“VirtualRealitySystems”AddisonWesley1995
2. KarlAspelund,“TheDesignProcess”,3rdEdition,2014
3. BrianWood,“AdobeIllustratorCCClassroom”,1stEdition,2019
4. JosephA.Gatto,“ExploringVisualDesign:TheElementsandPrinciples”, 2010

**Reference Books:**

1. ErinPangilinan,SteveLukas,etal.‘CreatingAugmentedandVirtualRealities: Theory and Practice for Next-Generation Spatial Computing’, Apr 14, 2019
2. SteveAukstakalnis,‘PracticalAugmentedReality:AGuidetotheTechnologies, Applications, and Human Factors for AR and VR (Usability)

**Elective1C**

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| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **3** |

**PATTERNRECOGNITIONANDIMAGEANALYSIS**

***CourseObjective:***

* 1. Tobefamiliarwithprocessingofimages,recognitionofthepatternandtheir applications

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Get acquainted with natural language processing

CO2.ApplybasicalgorithmsinNLP

CO3.Understandthealgorithmicdescriptionofthemainlanguagelevels CO4. Grasp basics of knowledge representation

CO5.Recognizepatterns

**UnitI 12hours**

IntroductiontoImageProcessing:Imageformation,imagegeometryperspective andothertransformation,stereoimagingelementsofvisualperception.Digital Image- sampling and quantization serial & parallel Image processing.

**UnitII 12hours**

Image Restoration: Constrained and unconstrained restoration Wiener filter, motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.

**UnitIII 12hours**

Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors,Skeltondetection,Houghtrans-form,topologicalandtextureanalysis, shape matching.

**UnitIV 12hours**

Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

**UnitV 12hours**

Statistical Pattern Recognition -Bayesian Decision Theory, Classifiers, Normal densityanddiscriminantfunctions,Parameterestimationmethods:Maximum-

Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods – Principal Component Analysis (PCA), Fisher Linear discriminant analysis,Expectation-maximization(EM),HiddenMarkovModels(HMM),Gaussian mixture models.

**CO-PO -PSOMapping**

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| **PATTERNRECOGNITIONANDIMAGEANALYSIS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K– 1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TEXTBOOKS**

1. DigitalImageProcessing–GonzalezandWood,AddisonWesley,1993.
2. FundamentalofImageProcessing–AnilK.Jain,PrenticeHallofIndia.
3. PatternClassification–R.O.Duda,P.E.HartandD.G.Stork,Second Edition John Wiley, 2006

**REFERENCE BOOKS**

1. DigitalPictureProcessing–RosenfeldandKak,vol.I &vol.II, Academic,1982
2. ComputerVision–BallardandBrown,PrenticeHall,1982
3. AnIntroductiontoDigitalImageProcessing–WayneNiblack,PrenticeHall, 1986
4. PatternRecognitionandMachineLearning–C.M.Bishop,Springer,2009.
5. PatternRecognition–S.TheodoridisandK.Koutroumbas,4thEdition, Academic Press, 2009

**Core12Practical3**

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| **L** | **T** | **P** | **C** |
| **0** | **0** | **4** | **2** |

**MACHINELEARNINGLABWITHPYTHON/R& HADOOP**

***CourseObjectives:***

1. ToapplytheconceptsofMachineLearningtosolvereal-worldproblems
2. Toimplementbasicalgorithmsinclustering&classificationappliedto text & numeric data
3. Toimplementalgorithmsemphasizingtheimportanceofbagging& boosting in classification & regression
4. Toimplementalgorithmsrelatedtodimensionalityreduction
5. ToapplymachinelearningalgorithmsforNaturalLanguageProcessing applications

***CourseOutcome:***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Implementmachinelearningalgorithmsrelatedto numericdata CO2. Apply machine learning algorithms for text data

CO3.Usedimensionalityreductionalgorithmsforimageprocessing applications

CO4. Distinguish Clustering and Classification CO5.ApplyCRFsinNaturalLanguageProcessing

**LISTOFEXERCISES**

1. SolvingRegression&ClassificationusingDecisionTrees
2. RootNodeAttributeSelectionforDecisionTreesusingInformationGain
3. BayesianInferenceinGeneExpressionAnalysis
4. PatternRecognitionApplicationusingBayesianInference
5. Baggingin Classification
6. Bagging,BoostingapplicationsusingRegressionTrees
7. Data&TextClassificationusingNeuralNetworks
8. UsingWekatoolforSVMclassificationforchosendomainapplication
9. Data&TextClusteringusingK-means algorithm
10. Data&TextClusteringusingGaussianMixtureModels
11. DimensionalityReductionAlgorithmsinImageProcessingapplications
12. ApplicationofCRFsinNaturalLanguageProcessing

**CO-PO -PSOMapping**

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| **MACHINELEARNINGLABWITHPYTHON/R&HADOOP** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Core13Practical4**

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| **L** | **T** | **P** | **C** |
| **0** | **0** | **4** | **2** |

**ADVANCEDWEBTECHNOLOGYLAB**

***CourseObjectives:***

1. Explore the backbone of web page creation by developing HTML 5and XML, Java Scripting, PHP and MySQL skill.
2. Providein-depthknowledgeaboutJS,PHP,MySQLandAJAX

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Recognize the importance of validation control

CO2.Analyzecookiesand session

CO3.ApplytheknowledgeofJavaScriptobject,dataaccessandSQLto develop a client servermodel.

CO4.DesignWebapplicationsusingvarioustechnologiessuchasJava,XML, AJAX, Servlets,PHP, JSP, MySQL and MEAN STACK

CO5.ImplementDatabase connectivity

**LISTOFEXERCISES**

1. Displayfivedifferentimages.Skiptwolinesbetweeneachimage.Each image shouldhave a title.
2. Printtwoaddressesinthesameformatusedonthefrontofenvelopes (senders address intop left corner, receivers address in the center)
3. Createapagewithalinkatthetopofitthatwhenclickedwilljumpallthe waytothebottomofthepage.Atthebottomofthepagethereshouldbea link to jump back to thetop of the page.
4. CreateWebAnimationwithaudiousingHTML5 & CSS3
5. DemonstrateGeolocationandCanvasusingHTML5
6. WriteanXMLfileandvalidateusingDocumentTypeDefinition (DTD)
7. DemonstrateDOMandSAXparser
8. WriteaJavaScriptprogramtodemonstrateFormValidationandEvent Handling
9. Designasimple online testweb pagein PHP
10. Write a JavaScript to implement a web application that lists all cookies stored in the browser on clicking List Cookies button.Add cookies if necessary
11. CreateanapplicationusingAngularJS
12. DemonstrateAngularJSformsanddirectives
13. Demonstrateto fetchtheinformation fromanXMLfile withAJAX
14. ImplementwebapplicationusingAJAXwithJSON
15. DemonstrateNode. js file system module
16. WriteaPHPprogramtokeeptrackofthenumberofvisitorsvisitingtheweb page and todisplay this count of visitors, with proper headings
17. ImplementDatabaseconnectivityMySqlwithPHP

**CO-PO -PSOMapping**

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| **ADVANCEDWEBTECHNOLOGYLAB** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**SemesterIII&IV**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Course No. | Course status | Course Title | Contact Hrs | Credits |
| 15 | Core 14 | NaturalLanguageProcessing | 4 | 4 |
| 16 | Core 15 | Internetof Things | 4 | 4 |
| 17 | Core 16 | Optimization Techniques | 4 | 4 |
| 18 | Core 17 | ResearchMethodology | 4 | 4 |
| 19 | Elective2 | Deep Learning/Robotics / Cryptography&NetworkSecurity | 4 | 3 |
| 20 | Core18Practical5 | NaturalLanguageProcessing Lab | 4 | 2 |
| 21 | Core 19 | Mini Project | 6 | 6 |
|  |  | SubTotal | 30 | 27 |
| 22 | Core 20 | Major Project | 30 | 16 |

**Core14**

**NATURALLANGUAGEPROCESSING**

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***CourseObjectives:***

* 1. Tounderstandthealgorithmsavailablefortheprocessingoflinguistic information and computational properties of natural languages.
	2. Toconceivebasicknowledgeonvariousmorphological,syntacticand semantic NLP tasks.

***CourseOutcome:***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Describetheconceptsofmorphology,syntax,semantics,discourse& pragmatics of natural language.

CO2.DiscovervariouslinguisticsrelevanttoNLPtasks CO3. Identify statistical features relevant to NLP tasks CO4. Analyze parsing in NLP

CO5.DevelopsystemsforvariousNLPproblemswithmoderate complexity.

**UNIT-I 12hours**

Introduction to NLP: NLP – introduction and applications, NLP phases, Difficultyof NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

**UNIT-II 12hours**

Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development.

**UNIT-III 12hours**

Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tag set; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

**UNIT-IV 12hours**

Parsing Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

**UNIT-V 12hours**

Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embedding from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet

**CO-PO -PSOMapping**

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| **NATURALLANGUAGEPROCESSING** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**Text book:**

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

JurafskyDanandMartinJamesS.“SpeechandLanguageProcessing”,3rd Edition, 2018.

**Reference books:**

1. Jurafsky D.and Martin J.S., “Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav “A Primer on Neural Network Models for Natural Language Processing”.

**Core15**

**INTERNET OF THINGS**

***CourseObjectives:***

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **4** |

* 1. TogainknowledgeonInternetofThings(IoT),IoTArchitecture,andthe Protocols
	2. TounderstandtheconceptofWebofThingsandtherelationship between IoT &WoT

***CourseOutcome***:

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Gain the basic knowledge about IoT

CO2. UseIoTrelatedproductsinreallife.

CO3.Relylessonphysicalresourcesandstarttodoworksmarter. CO4. Analyze opportunities and challenges in IoT

CO5.UnderstandtheneedofSensorsandactuators

**UNIT-1 12hours**

The Internet of Things: An Overview - The Flavor of the Internet of Things, The “Internet” of “Things”- The Technology of the Internet of Things - Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices - Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway?, Web Thinking for Connected Devices, Small Pieces,LooselyJoined, First-Class Citizens On The Internet, GracefulDegradation, Affordances.

**UNIT– II 12hours**

Prototyping Embedded Devices – Electronics, Sensors, Actuators, Scaling Up the Electronics,EmbeddedComputingBasics,Microcontrollers,System-on-Chips,Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing ontheRaspberryPi,SomeNotesontheHardware,OpennessWhatAreSmart Objects? - Where Do Smart Objects Come From? Challengesfor Smart Objects **UNIT – III 12 hours**

Why IP for Smart Objects? – Interoperability, An Evolving and Versatile Architecture,StabilityandUniversalityoftheArchitectureScalability,

Configurationand Management, Small Footprint,What Are the Alternatives? Why Are Gateways Bad? Security for Smart Objects - The Three Properties of Security - “Security” by Obscurity, Encryption, Security Mechanisms for Smart Objects - Security Mechanisms in the IP Architecture, IPSec, TLS - Web Services for Smart Objects - Web Service Concepts - The Performance of Web Services for Smart Objects. - Connectivity Models for Smart Object Networks - Introduction, Autonomous Smart Object Networks, IOT - Extended Internet.

**UNIT– IV 12hours**

Smart Object Hardware and Software – Hardware - Software for Smart Objects – Energy Management - THE APPLICATIONS - Smart Grid – Introduction – Terminology - Core Grid NetworkMonitoringand -Control -Smart Metering(NAN) – HAN

UNIT–V **12hours**

Industrial Automation – Opportunities, Challenges, Use Cases Smart Cities and Urban Networks– Introduction - Urban Environmental Monitoring - Social Networks - Intelligent Transport Systems - Home Automation – Introduction -Main Applications and Use Cases - Technical Challenges and Network Characteristics- Building Automation – Emerging Application in Building automation- HealthMonitoring–Introduction -MainApplicationsandUseCase - Technical Challenges in Health Monitoring.

**CO-PO -PSOMapping**

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| **INTERNETOFTHINGS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TextBooks**

1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things,JohnWiley and Sons, Ltd 2014(Unit I & II)
2. Jean-Philippe Vasseur and Adam Dunkels, Interconnecting Smart Objects withIP-TheNextInternet,MorganKaufmannPublishers2010(UnitIIItoV)
3. CunoPfister,GettingStartedwiththeInternetofThings,Publishedby O’Reilly

**Referencebooks**

1. BrianUnderdah,TheInternetofThingsForDummies,KOREWireless Edition,
2. OvidiuVermesanandPeterFriess,InternetofThingsApplications:From Research to Market Deployment, River Publishers
3. FrancisdaCosta,RethinkingtheInternetofThings–AScalableApproach toConnecting Everything, Apress

**Core16**

**OPTIMIZATIONTECHNIQUES**

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***Courseobjectives:***

1. Toapplyvariousoptimizationtechniquesfordecision making.
2. Tointroducetheuseofvariablesforformulatingcomplexmathematicalmodels in management, science and industrial applications

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Formulate and solve Linear Programming Problems.

CO2.ExaminetheTwoPhasemethod

CO3.AnalyzetheusageofIntegerProgrammingProblem.

CO4. Evaluate the Sequencing Problems and Queueing Models. CO5.ApplyPERTandCPMtechniquestofindtheoptimalsolution.

**UNIT I 12hours**

INTRODUCTION-LINEARPROGRAMMINGPROBLEM

The Nature and Meaning of OR – Management – Applications of OR – Modeling in OR – General methods for solving OR models – Scope of OR.

Linear Programming Problem: Formulation of LP problems – Graphical solution of LP problems – General formulation of LPP – Slack and Surplus variables – Standard form of LPP – Some important forms of LPP – Simplex Method and its special cases.

**UNIT II 12hours**

ARIFICIALVARIABLETECHNIQUESAND IPP

ArtificialVariableTechniques:TwoPhasemethodandspecial cases.

IntegerProgrammingProblem:Importance–Definitions–Gomory’sPureInteger Programming Problem – Mixed Integer Programming Problem.

**UNIT III 12hours**

ASSIGNMENTANDTRANSPORTATIONPROBLEMS

AssignmentProblem:Mathematicalformulation–Hungarianmethod–Unbalanced assignment problem – Various types

TransportationModel:Mathematicalformulation – Matrixform–Methodsfor finding Initial Basic Feasible solution and Optimal solution – Degeneracy in Transportation Problems – Unbalanced Transportation Problem.

**UNIT IV 12hours**

SEQUENCINGPROBLEMSANDQUEUINGMODELS

Sequencing Problems: Assumptions – Solutions to Sequencing Problems: Processing n jobs through 2 machines – Processing n jobs through 3 machines – Processing n jobs on m machines.

Queuing Models: Queuing System – Transient and Steady States– Kendal’s Notation for representing Queuing Models – Various Models in Queuing System – Birth and Death Model.

**UNIT V 12hours**

PERTANDCPMTECHNIQUES

PERT and CPM Techniques: Basic Steps – Network Diagram representation– Rules for drawing Network Diagram – Labeling Fulkerson’s I–J Rule – Time Estimates and Critical Path in Network Analysis – Examples on optimum duration and minimum duration cost – PERT.

**CO-PO -PSOMapping**

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| **OPTIMIZATIONTECHNIQUES** |
| **PO****CO** | **PSO** | **COGNITIVE LEVEL** |
|  | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TEXT BOOK**

S.D.Sharma,“OperationsResearch”,TenthEdition,Pearson,2017.

**REFERENCE BOOKS**

1. HamdyATaha,“OperationsResearch”,NinthEdition,2016.
2. V.Sundaresan,K.S.GanapathySubramanian,K.Ganesan,“Resource Management Techniques”, Ninth Edition, A. R.Publications, 2015.

**Core17**

**RESEARCH METHODOLOGY**

***Courseobjectives:***

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| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **4** |

1. TounderstandtheimportanceofResearchMethodology
2. Toapplystatisticaltestingtoprove hypothesis
3. Toprovidetheinferenceusingquantitativedataanalysis
4. Tomakeuseofcomputeraidstoanalyzethedata,preparereportsand presentations
5. Toevaluate methodologyof teaching

***CourseOutcome:***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Developdatacollectionaccordingtotheunderlyingtheoreticalframework. CO2. Analyze quantitative data and qualitative data using software packages CO3. Construct and document an appropriate research design

CO4.Understandthe ill-effectsof Plagiarism

CO5.BecomeagoodteacherusingICTbasedTeachingMethods

**UNIT-1 12hours**

INTRODUCTION OF RESEARCH AND FORMULATION: Motivation and Objectives–ResearchmethodsvsMethodology.Typesofresearch–Definingand formulatingthe research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review–Primaryandsecondarysources–Reviews,treatise,monographs,patents

–Criticalliteraturereview.RESEARCHDESIGNANDMETHODSResearchdesign

– Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design.

**UNIT– II 12hours**

Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models - Developing a research plan - Exploration, Description, Diagnosis, Experimentation - Determining experimental and sample design.DATA COLLECTION: Execution of the research - Observation and Collection of data - Methods of data collection.

**UNIT– III 12hours**

DATA ANALYSIS Quantitative Methods: Online Quantitative Design and Survey – DescriptiveMeasures–Probability–RandomVariablesandDistribution

Functions – Discrete Probability Distributions – Continuous Probability Distribution – Sampling Distributions – Theory of Estimation – Hypothesis Testing – Correlation – Regression – Principles of Sample Survey – Types of Sampling – Design of Experiments – CRD-RBD-LSD-Factor Analysis – Cluster Analysis – Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation

Application of Statistical Software Packages -REPORTING AND THESIS WRITING Reporting and thesis writing – Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in thepreparation – Layout, structureand Language of typical reports – Illustrations and tables - Bibliography, referencingand footnotes – Use of Oral presentation – Software Packages for thesis Preparation– Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication.

**UNIT– IV 12hours**

APPLICATION OF RESULTS AND ETHICS Application of results and ethics - Environmentalimpacts-Ethicalissues-ethicalcommittees-Commercialization– Copy right – royalty – Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights

Reproduction of published material – Plagiarism – Application of Plagiarism detection tools - Citation and acknowledgment - Reproducibility and accountability.

**UNIT– V 12hours**

METHODOLOGY OF TEACHING: Teaching – Objectives of Teaching, Phases of Teaching – Teaching Methods: Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project method, Seminar – Integrating ICT in Teaching: Individualised Instruction, Ways for Effective Presentation with PowerPoint – Documentation – Evaluation: Formative, Summative & Continuous and Comprehensive Evaluation – Later Adolescent Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development– Teaching LaterAdolescents.

**CO-PO -PSOMapping**

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| **RESEARCHMETHODOLOGY** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TextBooks**

1. CRKothari,“ResearchMethodology:MethodsandTechniques”, 2014
2. ModernLanguageAssociationHandbook,EightEdition,2016
3. R.Paneerselvam,“ResearchMethodology”2ndEdition,PHI,2014

**Referencebooks**

1. John W Creswel, Research Design: Qualitative, Quantitative, and Mixed MethodsApproaches, 3rd Edition, 2014
2. S.C.Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics, SultanChand& Sons, New Delhi, 2014 Edition.
3. S.C.Gupta & V.K.Kapoor, Fundamentals of Applied Statistics, Sultan Chand &Sons.2014 Edition.
4. Sampath. K, Panneerselvam. A & Santhanam. S (1984), Introduction to EducationalTechnology(2ndRevisedEd.)NewDelhi:SterlingPublishers.
5. Sharma.S.R(2003).Effective Classroom teaching modern methods, tools & techniques, Jaipur: Mangal Deep.
6. Vedanayagam.E.G (1989).Teaching Technology for College Teachers, Newyork:Sterling Publishers.

**DEEP LEARNING**

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**Elective2A**

***CourseObjective***

1. TointroducethefundamentaltechniquesandprinciplesofNeural Networks
2. Tofamiliarize fundamental concepts in Deep Learning

***CourseOutcome***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Become familiar with the fundamental concepts in Deep Learning

CO2.ExploretheuseofDeepLearningtechnologyincomputervision,speech analysis, healthcare, agriculture, and understanding climate change.

CO3.ApplyDeepLearningtechnologyincomputervision,speechanalysis, Health care, agriculture, and understanding climate change

CO4.AnalyzeDeepReinforcementLearning

CO5.EvaluatethePracticalChallengesinDeep Learning

**Unit I 12hours**

Introduction to Neural Networks – Introduction – Basic Architecture of Neural Networks – Training and Neural Network with Backpropagation – Practical Issues in Neural Network Training – The Secrets to the Power of Function Composition – Common Neural Architectures – Advanced Topics.

**Unit II 12hours**

Machine Learning with Shallow Neural Networks: Introduction – Neural Architectures for Binary Classification Models – Neural Architectures for Multiclass models – Back propagated saliency for Feature Selection – Matrix Factorization with Auto encoders – Simple Neural Architectures for Graph Embedding.

**Unit III 12hours**

Training Deep Neural Networks: Introduction – Backpropagation – Setup and Initialization issues – The vanishing and exploding gradient problems – Gradient DescentStrategies’ –BatchNormalization–TeachingDeepLearnerstoGeneralize: Introduction –The Bias-Variance trade-off – Generalization issues in model tuning and evaluation – Penalty based regularization – Ensemble methods – Early Stopping – Unsupervised pre-training – Continuation and Curriculum learning – Parameter sharing – Regularization in Unsupervised Applications.

**Unit IV 12hours**

Recurrent Neural Networks: Introduction – Architecture of Recurrent Neural Networks –ThechallengesoftrainingrecurrentNetworks–Echo-StateNetworks–

Long Short-Term memory – Gated Recurrent Units – Applications of Recurrent Neural Networks.

Convolutional Neural Networks: Introduction – The Basic Structure of a Convolutional Network – Training a convolutional network – Case studies of Convolutional Architectures – Visualization and Unsupervised Learning – Applications of Covolutional networks.

**UnitV 12hours**

Deep Reinforcement Learning: Introduction – Stateless Algorithms – The basic framework of Reinforcement Learning – Bootstrapping for value function learning– Policy Gradient Methods – Monte Carlo Tree Search – Case Studies – Practical Challenges associated with safety.

AdvancedTopicsassociatedwithDeepLearning:GenerativeAdversarialNetworks (GAN) – Competitive Learning – Limitations of Neural Networks.

**CO-PO -PSOMapping**

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| **DEEPLEARNING** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |

**Textbook**

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

CharuC.Aggarwal,NeuralNetwoksandDeepLearning,Springer 2018

**Reference books:**

1. IanGoodfellow,YoshuaBengioandAaronCourville,DeepLearning,The MIT Press, 2016
2. FrancoisChollet,DeepLearningwithPython,ManningPublicationsCo, 2018
3. JoshPatterson,AdamGibson,DeepLearning:APractitioner’sApproach1stEdition, O’Reilly’ 2017.

**Elective2B**

***CourseObjectives:***

**ROBOTICS**

1. TounderstandthefunctionsofthebasiccomponentsofaRobot

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1. TostudytheuseofvarioustypesofEndEffectorsand Sensors
2. ToimpartknowledgeinRobotKinematicsandProgramming

***CourseOutcome:***

On successful completion of the course, the learners will be able to CO1. Understand the functions of the basiccomponents of a Robot CO2.AnalyzetheuseofvarioustypesofEndEffectorsandSensors CO3. Gain knowledge in Robot Kinematics and Programming

CO4.AscertainSafetyConsiderationsforRobotOperations CO5. Determine the feasibility of implementing a Robot

**UNITI 12hours**

Fundamentals of Robot: Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw,Roll,JointNotations,SpeedofMotion,PayLoadRobot Partsandtheir Functions-Need for Robots-Different Applications.

**UNITII 12hours**

Robot Drive Systems And End Effectors**:** Pneumatic Drives-Hydraulic Drives-MechanicalDrives - ElectricalDrives- D. C.Servo Motors, Stepper Motors, A/CServo Motors -Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers- Mechanical Grippers,Pneumatic and Hydraulic- Grippers, Magnetic Grippers,Vacuum Grippers;TwoFingeredandThreeFingeredGrippers;InternalGrippersand External Grippers; Selection and Design Considerations.

**UNITIII 12hours**

Sensors & Machine Vision: Requirements, Principles & Applications of the following types of sensors- Position - Piezo Electric, LVDT, Resolvers, Optical Encoders, pneumatic Position, Range- Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Sensors- Touch–binary–Analog-Wrist-Compliance-Slip-Camera, Frame Grabber, Sensing and DigitizingImage Data- Signal Conversion,Image Storage,LightingTechniques,ImageProcessing&Analysis-DataReduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

**UNITIV 12hours**

Robot Kinematics And Robot Programming: Forward Kinematics, Inverse KinematicsandDifference;ForwardKinematicsandReverseKinematicsof

manipulators with Two, Three Degrees of Freedom (in 2Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces- Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems.Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

**UNITV 12hours**

Implementation and Robot Economics: RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

**CO-PO -PSOMapping**

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| **ROBOTICS** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TEXTBOOKS:**

1. KlafterR.D.,ChmielewskiT.AandNeginM.,“RoboticEngineering - AnIntegrated Approach”, Prentice Hall, 2019.
2. GrooverM.P.,“IndustrialRobotics-TechnologyProgrammingand Applications”, McGrawHill, 2018.

**REFERENCEBOOKS**:

1. CraigJ.J.,“IntroductiontoRoboticsMechanicsandControl”, PearsonEducation, 2017.
2. KorenY.,“Robotics forEngineers",McGrawHillBookCo.,2019.
3. Fu. K. S., Gonzalez R. C.and LeeC. S. G.,“Robotics Control, Sensing,VisionandIntelligence”,McGrawHillBookCo.,2017
4. JanakiramanP.A.,“RoboticsandImageProcessing”,TataMcGraw Hill, 2015.

**Elective2C**

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| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **3** |

**CRYPTOGRAPHYANDNETWORKSECURITY**

***CourseObjectives:***

1. Tounderstandsecuritydesignprinciplesandmathematicsbehind cryptography
2. TounderstandthesecurityrequirementsinOS,databasesand networking

***CourseOutcome:***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.Illustratetheapproaches,trade-offsinsecuritydesignprinciples. CO2. Apply number theory in public key encryption techniques

CO3.Understandthesecurityrequirements CO4. Analyze Virus – counter measures CO5. Design a secure system

**UNIT-1 12**

Introduction-Security trends–The OSI security architecture– Security attacks, services and mechanisms– A Model of network security-Security Goals- CryptographicAttacks––Classicalencryptiontechniques:SymmetriccipherModel- substitution-transposition -steganography- Block cipher and the DES: Block cipher Principles – DES - The strength of DES- Differential and Linear Crypt Analysis-Block Cipher Design Principles.

**UNIT– II 12hours**

Advanced Encryption Standard- AES Cipher-More on Symmetric Ciphers: Block Cipher modesof operation-Stream Cipher and RC4. Public-Key Encryption and Hash Function: Prime Numbers-Testing for Primality - The Chinese remainder theorem-Public-Key Cryptography and RSA: Principles of Public Key Cryptosystem- The RSA Algorithm-Key Management -Diffie-Hellman Key Exchange-MessageAuthenticationandHashFunction:AuthenticationFunction – Message Authentication Codes-Hash function – HMAC – CMAC - DigitalSignature-Authentication Protocol.

**UNIT– III 12hours**

Authentication Applications – Kerberos-x. 509 Authentication Service-Public- KeyInfrastructure- Secret Key Algorithm-Security at the Application Layer: Electronic Mail Security-Pretty Good Privacy (PGP)- S/MIME.

**UNIT– IV 12hours**

IPSecurity- IPSecurity – Overview - IPSecurity - Architecture,-Authentication- Header- Encapsulating Security Payload- Combining Security Associations.Web Security: Web Security Considerations-Secure Socket Layer (SSL) and Transport Layer Security (TLS)-Secure Electronic Transaction (SET). Network Management Security :Basic Concepts of SNMP, SNMPv1, SNMPv3, VPN.

**UNIT– V 12hours**

System Security: Intruders - Intruders, Intrusion Detection- Password Management-Malware.Malicious Software: Viruses and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks.Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for information technology Security Evaluation.Legal and Ethical Issues in Computer Security: Protecting Programs Data-Information and the Law-Redress for Software failures-Selling Correct Software Flaws.

**CO-PO -PSOMapping**

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| **CRYPTOGRAPHYANDNETWORKSECURITY** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K– 2** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 3** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**TextBooks:**

1. StallingsWilliam,“Cryptography&NetworkSecurity,Principles&Practice”,2017.
2. Behrouz A.Ferouzan, “Cryptography & Network Security”, Tata McGraw Hill, 2007, Reprint 2015.
3. Charless P.Pfleeger, Shari Lawrence Pfleeger, “ Security in Computing”, Fourth Edition, 2007

**ReferenceBooks:**

1. YoungManRhee,“InternetSecurity:CryptographicPrinciples,Algorithms& Protocols”, Wiley Publications, 2003.
2. UlyssesBlack,“InternetSecurityProtocols”,PearsonEducationAsia,2000.
3. Charlie Kaufman, Radia Perlman, Mike Speciner, “Network Security: Private Communication In Public World”, PHI, 2002.
4. Bruce Schneier, Neils Ferguson, “Practical Cryptography”,First Edition,WileyDreamtech India Pvt Ltd, 2003.
5. DouglasRSimson“Cryptography–TheoryandPractice”,FirstEdition,CRC Press, 1995.

**Core18Practical5**

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| **L** | **T** | **P** | **C** |
| **4** | **0** | **0** | **4** |

**NATURALLANGUAGEPROCESSINGLAB**

***CourseObjective:***

1. TofamiliarizethestudentswithpracticalaspectsofprocessingNatural Language.

***CourseOutcome:***

Onsuccessful completionof thecourse, thelearners willbeable to

CO1.ImplementcommonNLPtasksusingPythonandNaturalLanguage Toolkit, NLTK

CO2.Describetheconceptsofmorphology,syntax,semantics,discourse& pragmatics of natural language.

CO3.DiscovervariouslinguisticsrelevanttoNLPtasks CO4. Analyze parsing in NLP

CO5.DevelopsystemsforvariousNLPproblemswithmoderate complexity.

**PracticalList**

* 1. Tokenizing Text and WordNet basics: Tokenizing text into sentences, Tokenizing sentences into words, Tokenizing sentences using regular expressions, Filtering stop words in a tokenized sentence, Looking up synsets for a word in WordNet, Looking up lemmas and synonyms in WordNet, Calculating WordNet synset similarity Discovering word collocations.
	2. Replacing and correcting words: Stemming words, Lemmatizing words with WordNet, Translating text with Babelfish, Replacing words matching regular expressions, Removing repeating characters, Spelling correction with Enchant, Replacing synonyms, Replacing negations with antonyms.
	3. Creating Custom Corpora : Setting up acustom corpus, Creating a word list corpus, Creating a part of speech tagged word corpus, Creating a chunked phrase corpus, Creating a categorized text corpus, Creating a categorized chunk corpus reader, Lazy corpus loading, Creating a custom corpus view, Creating a MongoDB backed corpus reader, Corpus editing with file locking.
	4. Parts-of -Speech Tagging: Training a unigram part-of-speech tagger, Combining taggers with backoff tagging, Training and combining Ngram taggers, Creating a model of likely word tags, Tagging with regular expressions, Affix tagging, Training a Brill tagger, Training the TnT tagger Using WordNet for tagging, Tagging proper names, Classifier based tagging.
	5. Extracting Chunks : Chunking and chinking with regular expressions, Merging and splitting chunks with regular expressions, Expanding and removing chunks with regular expressions, Partial parsing with regular expressions, Training a tagger-based chunker, Classification-based chunking, extracting named entities, Extracting proper noun chunks, Extracting location chunks, Training a named entity chunker.
	6. Transforming Chunks and Trees: Filtering insignificant words, Correcting verb forms, Swapping verb phrases, Swapping noun cardinals, Swapping infinitive phrases, Singularizing plural nouns, Chaining chunk transformations, Converting a chunk tree to text, Flattening a deep tree, Creating a shallow tree, Converting tree nodes.
	7. Parsing Specific Data: Parsing dates and times with Dateutil, Time zone lookup and conversion, Tagging temporal expressions with Timex,Extracting URLs from HTML with lxml, Cleaning and stripping HTML, Converting HTML entities with Beautiful Soup.

**CO-PO -PSOMapping**

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| **NATURALLANGUAGEPROCESSINGLAB** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K– 1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 3** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 5** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 4** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

References

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

1. PythonTextprocessingwithNLTK2.0Cookbook,JacobPerkins,PACKT Publishing
2. NaturalLanguageProcessingwithPython,StevenBird,EwanKlein,and Edward Loper, O’ Reilly

**Core19**

**MINIPROJECT**

* 1. EachstudenthastoundergoanindividualprojectintheInstitution

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| **0** | **0** | **6** | **6** |

* 1. InternalProjectSupervisorshallbeallocatedforeachstudent**.**

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Develop a model to achieve the project's goal

CO2.Demonstratesoundtechnicalknowledgeoftheselectedprojecttopic. CO3. Undertake problem identification, formulation and solution.

CO4.Designsolutionstocomplexproblemsutilisingasystematicapproach CO5. Appreciate the steps involved in Software development process

**CO-PO -PSOMapping**

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| **MINIPROJECT** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-1** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-2** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-3** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**

**Core20**

**SEMESTERVI**

**MAJORPROJECT**

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1. Each student has to undergo an individual project either in the Institution or in a reputed industry
2. InternalProjectSupervisorshallbeallocatedforeachstudent**.**

***CourseOutcome:***

Onsuccessfulcompletionofthecourse,thelearnerswillbeableto CO1. Develop a model to achieve the project's goal

CO2.Demonstratesoundtechnicalknowledgeoftheselectedprojecttopic. CO3. Undertake problem identification, formulation and solution.

CO4.Designsolutionstocomplexproblemsutilisingasystematicapproach CO5. Appreciate the steps involved in Software development process

**CO-PO -PSOMapping**

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| **MAJORPROJECT** |
| **CO** | **PO** | **PSO** | **COGNITIVE LEVEL** |
| **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| **CO1** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** | **K-4** |
| **CO2** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-5** |
| **CO3** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-6** |
| **CO4** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K-1** |
| **CO5** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **K– 6** |

**StronglyCorrelated–S,Moderately Correlated–M,WeeklyCorrelated-L**