KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

M.Tech in Computer Science and Engineering

COURSE STRUCTURE & SYLLABUS - M. TECH (CSE-AI&ML) –R23 Regulation

(Applicable from the academic year: 2024-25 onwards)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE STRUCTURE & SYLLABUS - M. TECH (CSE-AI&ML) – R23 Regulation

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M.Tech.– IYear I Semester (SEMESTER-I)

S. No	Course Cat	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PCC	**23AM1T01**	Artificial Intelligence and Intelligent Systems	3	0	0	3	25	75	100
2	PCC	**23AM1T02**	Machine Learning	3	0	0	3	25	75	100
3	PEC-I	**23AM1E01** **23AM1E02** **23AM1E03**	**Professional Elective - I** i) Advanced Data Structures & Algorithms ii) Introduction to Data Science iii) Data Mining Techniques	3	0	0	3	25	75	100
4	PEC-II	**23AM1E04** **23AM1E05** **23AM1E06**	**Professional Elective - II** i) Cloud Computing ii) Game Theory and Applications iii) Hadoop & Big Data	3	0	0	3	25	75	100
5	MC	**23GR1A01**	Research Methodology and IPR	2	0	0	2	25	75	100
6	AC	**23GS1A0X**	Audit Courses (AC)-I	2	0	0	0	---	---	---
7	PCC	**23AM1L01**	Artificial Intelligence and Intelligent SystemsLab	0	0	2	2	25	75	100
8	PCC	**23AM1L02**	Machine Learning Lab	0	0	2	2	25	75	100
			Total Credits				**18**	**175**	**525**	**700**

Theory: PC-2, MC-1, AC-1, PE-I-1, PE-II-1 **Practical:** PC-2

M.Tech.– I Year II Semester (SEMESTER-II)

S. No	Course Cat	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PCC	**23AM2T01**	Deep Learning	3	0	0	3	25	75	100
2	PCC	**23AM2T02**	Big Data Analytics	3	0	0	3	25	75	100
3	PEC-III	**23AM2E01** **23AM2E02** **23AM2E03**	**Professional Elective - III** i) Artificial Neural Networks ii) Soft Computing iii) Enterprise Cloud Concepts	3	0	0	3	25	75	100
4	PEC-IV	**23AM2E04** **23AM2E05** **23AM2E06**	**Professional Elective - IV** i) Natural Language Processing ii) Principles of Cyber Security iii) Social Network Analytics	3	0	0	3	25	75	100
5	PCC	**23AM2P01**	Mini Project with Seminar	0	0	0	2	100	--	100
6	AC	**23GS2A0X**	Audit Courses (AC)-II	2	0	0	0	---	---	---
7	PCC	**23AM2L01**	Deep Learning Lab	0	0	2	2	25	75	100
8	PCC	**23AM2L02**	Big Data Analytics Lab	0	0	2	2	25	75	100
			Total Credits				**18**	**250**	**450**	**700**

Theory: PC-3, PE-III-1, PE-IV-1, AC-1 Practical**:** PC-2

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M.Tech.– II Year I Semester (SEMESTER-III)

S. No	Course Cat	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PEC-V	**23AM3E01** **23AM3E02** **23AM3E03** **23AM3E04**	**Professional Elective - V** i) Machine Translation ii) Computer Vision iii) Robotics and Intelligent Systems iv) MOOCs-1 through NPTEL/ SWAYAM/ COURSER A 12 Week Program related to the program	3	0	0	3	25	75	100
2	OEC-I	**23AM3O01** **23AM3O02** **23AM3O03**	**Open Elective-I** i) Internet of Things (IoT) ii) Recommender Systems iii) MOOCs-2 through NPTEL/ SWAYAM/ COURSERA - Any 12-week course on Engineering/ Management/ Mathematics offered by other than parent department	3	0	0	3	25	75	100
3	PCC	**23AM3P01**	Dissertation Phase-I/Industrial Project#,$	0	0	20	10	100	--	100
			Total Credits				**16**	**150**	**150**	**300**

Theory: PC-3, PE-1, OE-1, ES-1 **Practical:** PC-2, SEC-1

M.Tech.– II Year II Semester (SEMESTER-IV)

S. No	Course Cat	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PCC	**23AM4P01**	Dissertation Phase-II	0	0	32	16	100	100	200
			Total Credits				**16**	**100**	**100**	**200**

List of Audit Course

1. Pedagogy Studies
2. Sanskrit for Technical Knowledge
3. Value Education
4. Constitution of India
5. English for Research Paper Writing
6. Disaster Management
7. Stress Management by yoga
8. Personality Development through Life Enlightenment Skills

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Artificial Intelligence and Intelligent Systems	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: At the end of the course, students should be able to:

CO-1: gain a historical perspective of AI and its foundations.
CO-2: solve basic AI based problems.
CO-3. define the concept of Artificial Intelligence.
CO-4. apply AI techniques to real-world problems to develop intelligent systems.
CO-5. select appropriately from a range of techniques when implementing intelligent systems.

UNIT - I

Introduction: Overview of AI problems, AI problems as NP, NP-Complete and NP Hard problems. Strong and weak, neat and scruffy, symbolic and sub-symbolic, knowledge-based and data-driven AI.

UNIT -II

Search Strategies: Problem spaces (states, goals and operators), problem solving by search, Heuristics and informed search, Min-max Search, Alpha-beta pruning. Constraint satisfaction (backtracking and local search methods).

UNIT - III

Knowledge representation and reasoning: propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem. Totally-ordered and partially-ordered Planning. Goal stack planning, Nonlinear planning, Hierarchical planning.

UNIT - IV

Learning: Learning from example, learning by advice, Explanation based learning, Learning in problem solving, Classification, Inductive learning, Naive Bayesian Classifier, decision trees. Natural Language Processing: Language models, n-grams, Vector space models, Bag of words, Text classification. Information retrieval.

UNIT - V

Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems- Collaborating agents, Competitive agents, Swarm systems and biologically inspired models. Intelligent Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Key Application Areas: Expert system, decision support systems, Speech and vision, Natural language processing, Information Retrieval, Semantic Web.

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TEXT BOOK:

1. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall

REFERENCES:

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.

Online Resources:

1. https://nptel.ac.in/courses/106102220
2. https://nptel.ac.in/courses/106105078
3. http://www.digimat.in/nptel/courses/video/106105077/L25.html

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Machine Learning	L	T	P	C
		3	0	0	3

Course Objectives:

- Develop an appreciation for what is involved in learning from data.
- Demonstrate a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes: At the end of the course, students should be able to:

CO-1: gain domain knowledge for Productive use of Machine Learning and Diversity of Data. demonstrate on Supervised and Computational Learning

CO-2: analyze on Statistics in learning techniques and Logistic Regression Illustrate on Support Vector Machines and Perceptron Algorithm

CO-3: design a Multilayer Perceptron Networks and classification of decision tree

CO-4: implement procedures for the machine learning algorithms

CO-5: identify and apply Machine Learning algorithms to solve real world problems

Unit I:

Introduction: Towards Intelligent Machines Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

Unit II:

Supervised Learning: Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Over fitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

Unit III:

Statistical Learning: Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification,Minimum Description Length Principle.

Unit IV:

Support Vector Machines (SVM): Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly seperable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, and Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

Unit V:

Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. **Decision Tree Learning**: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

TEXTBOOKS:

1. Applied Machine Learning,1st edition, M.Gopal, McGraw Hill Education,2018
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC) 1st Edition-2014

REFERENCE BOOKS:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William WHsieh, Cambridge Univ Press. *1* edition (August 31, 2009)
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & SonsInc., 2nd Edition-2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
4. Machine Learning by Peter Flach , Cambridge-1st Edition 2012.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs29/preview
2. https://archive.nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs49/
3. https://onlinecourses.nptel.ac.in/noc20_cs95/preview

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	PE-1: Advanced Data Structures & Algorithms	L	T	P	C
		3	0	0	3

Course Objectives:

From the course the student will learn

- Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.
- Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.
- AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

Course Outcomes: At the end of the course, students should be able to

CO-1: ability to create, manipulate, and traverse singly linked lists, including operations like insertion, deletion, and searching

CO-2: design and implement variety of data structures including, binary trees, heaps, graphs and search trees

CO-3: master a variety of advanced abstract data type (ADT) and data structures and their Implementation

CO-4: demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life

CO-5: will compare and contrast the advantages and disadvantages of AVL, Red-Black, Splay, and B-trees regarding performance and use cases.

UNIT I: I

Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. **Stacks and Queues**: Algorithm Implementation using Linked Lists.

UNIT II:

Searching-Linear and Binary, Search Methods, **Sorting**-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. **Trees**- Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). **Graphs**-Basic Concepts, Storage structures and Traversals.

UNIT III:

Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, **Open Addressing**-Linear Probing, Double Hashing.

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UNIT IV:

Priority queues- Definition, ADT, realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion. Search **Trees**- Binary Search Trees, Definition, ADT, Implementation, **Operations**- Searching, Insertion, Deletion.

UNIT V:

Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java,2/e, Sartaj Sahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasadand S Chand & Co, 2009

Online Resources:

1. https://nptel.ac.in/courses/106102064
2. https://archive.nptel.ac.in/courses/106/102/106102064/
3. https://nptelvideos.com/video.php?id=1004

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	PE-1: Introduction To Data Science	L	T	P	C
		3	0	0	3

Course Objectives:

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for datascience;
- Produce Python code to statistically analyses a dataset;
- Critically evaluate data visualizations based on their design and use for communicating storiesfrom data;

Course Outcomes: At the end of the course, students should be able to:

CO-1: explain how data is collected, managed and stored for data science;
CO-2: understand the key concepts in data science, including their real-world applications and thetoolkit used by data scientists
CO-3: implement data collection and management scripts using MongoDB
CO-4: demonstrate proficiency with statistical analysis of data.
CO-5: data science concepts and methods to **solve** problems in real-world contexts and will communicate these solutions effectively

UNIT – I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

UNIT – II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data Sources

UNIT-III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basicmachine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-IV

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT-V

Applications of Data Science, Technologies for visualization, Bokeh (Python). Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Text Book:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly.

References

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, CambridgeUniversity Press.

Online Resources:

1. https://nptel.ac.in/courses/106106179
2. https://www.youtube.com/playlist?list=PLw5h0DiJ-9PCn4shW4X43FSjEqdBwc1Cn
3. https://nptel.ac.in/domains/discipline/106?course=106_1

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	PE-1: Data Mining Techniques	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand data mining concepts.
- To learn about various data preprocessing techniques.
- To learn about data warehousing.
- To learn about various data mining functionalities such as association rule mining, clustering,classification and outlier analysis.

Course Outcomes: At the end of the course, students should be able to:

CO-1: understand the functionality of the various data mining and data warehousing component

CO-2: appreciate the strengths and limitations of various data mining and data warehousing models

CO-3: explain the analyzing techniques of various data

CO-4: describe different methodologies used in data mining and data ware housing.

CO-5: compare different approaches of data ware housing and data mining with various technologies.

UNIT - I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT - II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Usage of Data Warehousing Online Analytical Processing and Mining Data Cube Computation: Efficient Methods for simple Data Cube Computation (Full Cube, Iceberg Cube, Closed Cube and Shell Cube), Discovery Driven exploration of data cubes, Attribute-Oriented Induction for data characterization and its implementation

UNIT - III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, The Apriori

algorithm for finding frequent itemsets using candidate generation, Generating association rules from frequent itemsets, Mining frequent itemsets without candidate generation, Mining various kinds of Association Rules, Correlation Analysis

UNIT - IV

Classification and Prediction: Description and comparison of classification and prediction, preparing data for Classification and Prediction Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Backpropagation Prediction, linear and non- linear regression, evaluating accuracy of a Classifier or a Predictor

UNIT - V

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, k-means and k-mediods methods, CLARANS, Agglomerative and divisive hierarchical clustering, chameleon dynamic modeling, DBSCAN, Grid based clustering method: STING, ConceptualClustering, Constraint-Based Cluster Analysis, Outlier Analysis.

Text Books:

1. Data Mining – Concepts and Techniques - Jiawei Han, Micheline Kamber and Jian Pei, 3rd edition,Morgan Kaufmann Publishers, ELSEVIER.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

References:

1. Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson Edn Asia.
2. Insight into Data Mining, K. P. Soman, S. Diwakar, V. Ajay, PHI, 2008.
3. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley student Edition
4. The Data Warehouse Life cycle Tool kit – Ralph Kimball Wiley student edition
5. Building the Data Warehouse By William H Inmon, John Wiley & Sons Inc, 2005.
6. Data Mining Introductory and advanced topics –Margaret H Dunham, Pearson education
7. Data Mining Techniques – Arun K Pujari, 2nd edition, Universities Press.
8. Data Mining, V. Pudi and P. Radha Krishna, Oxford University Press.
9. Data Mining: Methods and Techniques, A.B. M Shawkat Ali and S. A. Wasimi, Cengage Learning.
10. Data Warehouse 2.0, The Architecture for the next generation of Data Warehousing, W.H. Inmon, D. Strauss, G. Neushloss, Elsevier, Distributed by SPD.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. https://onlinecourses.swayam2.ac.in/cec19_cs01/preview

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	PE-2: Cloud Computing	L	T	P	C
		3	0	0	3

Course Objectives:

- The student will also learn how to apply trust-based security model to real-world security problems.
- An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes: At the end of the course, students should be able to

CO-1: understand different types of clouds and their applications
CO-2: identify security aspects of each cloud model
CO-3: develop a risk-management strategy formoving to the Cloud
CO-4: implement a public cloud instance using a public cloud service provider
CO-5: apply trust-based security model to different layer

UNIT – I

Introduction to Cloud Computing: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

UNIT – II

Cloud Computing Architecture: Requirements, Introduction Cloud computingarchitecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments,

CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models: Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in theEnterprise

UNIT - III

Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider

Data and Its Security Identity and Access Management: Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

UNIT - IV

Security Management in the Cloud Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT - V

Audit and Compliance Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud Advanced Topics Recent developments in hybrid cloud and cloud security.

Text Books:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009.

References:

1. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory inPractice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://archive.nptel.ac.in/courses/106/105/106105167/

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	PE-2: Game Theory and Applications	L	T	P	C
		3	0	0	3

Course Objectives:

- To teach students some strategic considerations to take into account making their choices.
- To learn basic concepts of game theory.
- To apply game theoretic models to real world problems

Course Outcomes: At the end of the course, students should be able to

CO-1: solve strategic games between two and more agents in non-cooperative scenario.

CO-2: analyze and solve both simultaneous-moves and sequential-moves games.

CO-3: learn different methods to solve games.

CO-4: the students will learn how to model multi-person decision-making in an interactive setting.

CO-5: understand how to formulate different real life situations as games and learn to predict the optimal strategies of players

UNIT - I

Introduction: games and decisions, Games Strategies, Costs and Payoff, Basic Solution Concepts, Finding equilibria and Learning in Games

UNIT - II

Zero-Sum Games: secure strategy, Maximin, Maximax, and Minimax Regret Solvability, value of a game. Normal form games: dominance, iterated dominance, Nash equilibrium. N-player games, mixed strategy nash equilibria.

UNIT - III

Graphical Games: Computing Nash, equilibria in Tree Graphical Games, Graphical Games and correlated Equilibria. Extensive form games: subgame perfection, sequential equilibrium, Stackelberg Model of Duopoly, Buying Votes, Committee Decision-Making. Bargaining: Rubinstein bargaining, Nash bargaining.

UNIT - IV

Repeated Games: Folk theorem and repeated prisoner's dilemma. Tacit collusion. Incomplete information games: Bayesian equilibrium, higher order beliefs.

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UNIT - V

Auctions and Mechanism Design: Basic auctions, voting, Vickrey-Clarke-Groves Auction. Cryptography and Game theory: cryptographic influence on game theory and Game theoretic influence on cryptography

TEXT BOOKS:

1. A Course in Game Theory by M. J. Osborne & A. Rubinstein, MIT Press.

REFERENCES:

1. Algorithmic Game Theory by N. Nisan, T. Rougharden, E. Tardos and V. V. Vazirani, Cambridge University Press.
2. Game Theory and Applications by TatsuroIchiishi, Abraham Neyman and YairTauman, Elsevier.
3. Essentials of Game Theory: A Concise, Multidisciplinary Introduction by K. Leyton-Brown and Y.Shoham, Morgan & Claypool Publishers.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ge32/preview
2. https://archive.nptel.ac.in/courses/110/104/110104063/

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	PE-2:Hadoop & Big Data	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand about big data
- To learn the analytics of Big Data
- To Understand the MapReduce fundamentals

Course Outcomes: At the end of the course, students should be able to

CO-1: understand Big Data and its analytics in the real world.

CO-2: analyze the Big Data framework like Hadoop efficiently store and process Big Data to generate analytics.

CO-3: design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm

CO-4: design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics

CO-5: implement Big Data Activities using Hive

UNIT - I

Big Data Analytics: What is big data, History of Data Management; Structuring Big Data; Elements of Big Data; Big Data Analytics; Distributed and Parallel Computing for Big Data; Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools.

UNIT - II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT - III

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize Map Reduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFC Files, File system types, commands, org.apache.hadoop.io package, HDF, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations Programming with HBase; Installation, Combining HBase and HDFS.

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UNIT - IV

Big Data Technology Landscape and Hadoop: NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFC (Hadoop Distributed File System), HDFC Daemons, read, write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets; Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

Text Books:

1. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. Big Data, Black BookTM , DreamTech Press, 2015 Edition.
3. Business Analytics 5e , BY Albright |Winston

Reference Books:

1. Rajiv Sabherwal, Irma Becerra- Fernandez," Business Intelligence –Practice, Technologies andManagement", John Wiley 2011.
2. Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPDShroff, 2012.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/arp19_ap60/preview
2. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-cs86/

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Research Methodology and IPR	L	T	P	C
		2	0	0	2

Course Objectives

- To introduce the basic concepts in research methodology in Social science.
- Addresses the issues inherent in selecting a research problem and discuss the techniques and tools to be employed in completing a research project.
- This will also enable the students to prepare report writing and framing Research proposals.

Course Outcomes: At the end of the course, students should be able to:

CO-1: understand and comprehend the basics in research methodology and applying them in research/ project work.

CO-2: to help them to select an appropriate research design.

CO-3: it will be able to take up and implement a research project/ study.

CO-4: develop skills in qualitative and quantitative data analysis and presentation.

CO-5: demonstrate the ability to choose methods appropriate to research objectives.

UNIT 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2:

Effective literature studies approach, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT 3:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 4:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

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UNIT 5:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Book:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introductionfor science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
3. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

REFERENCES:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ge36/preview
2. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
3. https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Artificial Intelligence and Intelligent Systems Lab	L	T	P	C
		0	0	2	2

Course Objectives:

1. To provide skills for designing and analyzing AI based algorithms.
2. To enable students to work on various AI tools.
3. To provide skills to work towards solution of real-life problems

Course Outcomes: At the end of the course, students should be able to
CO-1: elicit, analyze and specify software requirements.
CO-2: simulate a given problem scenario and analyze its performance.
CO-3: develop programming solutions for given problem scenario.
CO-4: solve basic AI based problems
CO-5: apply AI techniques to real-world problems to develop intelligent systems.

List of Programs:

1. Installation and working on various AI tools viz. Python, R tool, GATE, NLTK, MATLAB, etc.
2. Data preprocessing and annotation and creation of datasets.
3. Learn existing datasets and Treebanks
4. Implementation of searching techniques in AI.
5. Implementation of Knowledge representation schemes.
6. Natural language processing tool development.
7. Application of Machine learning algorithms.
8. Application of Classification and clustering problem.
9. Working on parallel algorithms.
10. Scientific distributions used in python for Data Science - Numpy, scifi, pandas, scikit learn, statsmodels, nltk.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall

REFERENCES:

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.

Online Resources:

1. https://nptel.ac.in/courses/106102220
2. https://nptel.ac.in/courses/106105078
3. http://www.digimat.in/nptel/courses/video/106105077/L25.html

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Machine Learning Lab	L	T	P	C
		0	0	2	2

Course Objectives:
This course will enable students to

- To learn and understand different Data sets in implementing the machine learning algorithms.
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes (COs): At the end of the course, student will be able to
CO-1: implement procedures for the machine learning algorithms
CO-2: design Python programs for various Learning algorithms
CO-3: apply appropriate data sets to the Machine Learning algorithms
CO-4: identify and apply Machine Learning algorithms to solve real world problems
CO-5: implement procedures for the machine learning algorithms

Experiment-1:
Exercises to solve the real-world problems using the following machine learning methods:

a) Linear Regression
b) Logistic Regression.

Experiment-2:
Write a program to Implement Support Vector Machines.

Experiment-3:
Exploratory Data Analysis for Classification using Pandas and Matplotlib.

Experiment-4:
Implement a program for Bias, Variance, and Cross Validation.

Experiment-5:
Write a program to simulate a perception network for pattern classification and function approximation.

Experiment-6:
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment-7:
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:
Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the classifier, considering few test data sets.

Experiment-9:
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment-10:
Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k- Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment-11:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

TEXTBOOKS:

1. Applied Machine Learning,1st edition, M.Gopal, McGraw Hill Education,2018
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis(CRC) 1st Edition-2014

REFERENCE BOOKS:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, WilliamWHsieh, Cambridge Univ Press. *1* edition (August 31, 2009)
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, JohnWiley & SonsInc., 2nd Edition-2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
4. Machine Learning by Peter Flach , Cambridge-1st Edition 2012.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs29/preview
2. https://archive.nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs49/
3. https://onlinecourses.nptel.ac.in/noc20_cs95/preview

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Department of Computer Science and Engineering

AC: PEDAGOGY STUDIES

COURSE OBJECTIVES:

1. Review existing evidence on the review topic to inform programme design andpolicy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

COURSE OUTCOMES: At the end of the course, students should be able to:

CO-1: will articulate the aims and rationale behind educational research, understanding its importance in informing policy and practice.

CO-2: learn What pedagogical practices are being used by teachers in formal and informal classroomsin developing countries.

CO-3: identify What is the evidence on the effectiveness of these pedagogical practices, in whatconditions, and with what population of learners.

CO-4: understand how can teacher education (curriculum and practicum) and the school curriculum andguidance materials best support effective pedagogy.

CO-5: will demonstrate the ability to align professional development strategies with effective classroom practices to enhance student learning.

CO-6: will understand the key components of effective research design and apply these principles to develop their own research projects in education

Syllabus		
Units	**Content**	**Hours**
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and searching.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	4
3	Evidence on the effectiveness of pedagogical practices Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	4
4	Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
5	Professional development: alignment with classroom practices and follow-up support Peer support, Support from the head teacher and thecommunity. Curriculum and assessment Barriers to learning: limited resources and large class sizes	4
6	**Research gaps and future directions** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	4

TEXTBOOKS:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London:DFID.

REFERENCES:

1. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston:Blackwell.
3. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read'campaign.

Online Resources:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.
2. https://onlinecourses.nptel.ac.in/noc22_ge13/preview

AC: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: At the end of the course, students should be able to:
CO-1: understanding basic Sanskrit language
CO-2: ancient Sanskrit literature about science & technology can be understood
CO-3: being a logical language will help to develop logic in students

Syllabus

Unit	Content	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	4
2	Order Introduction of roots technical information about Sanskrit Literature	4
3	Technical concepts of Engineering-Electrical,	4
4	Technical concepts of Engineering - Mechanical.	4
5	Technical concepts of Engineering - Architecture.	4
6	Technical concepts of Engineering – Mathematics.	4

TEXTBOOKS:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, NewDelhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri,Rashtriya Sanskrit Sansthanam, New DelhiPublication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

AC: VALUE EDUCATION

COURSE OBJECTIVES

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

COURSE OUTCOMES: At the end of the course, students should be able to:

CO-1: Knowledge of self-development
CO-2: Learn the importance of Human values
CO-3: Developing the overall personality

Unit	Content	Hours
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements	4
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration.Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love fornature, Discipline	4
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking.	4
4	Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature	4
5	Character and Competence –Holy books vs Blind faith. Self-managementand good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.	4
6	All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	4

TEXTBOOKS:

1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, NewDelhi

AC: CONSTITUTION OF INDIACOURSE

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: At the end of the course, students should be able to:

CO-1: discuss the growth of the demand for civil rights in India for the bulk of Indians beforethe arrival of Gandhi in Indian politics.

CO-2: discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO-3: discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO-4: discuss the passage of the Hindu Code Bill of1956.

Syllabus		
Units	**Content**	**Hours**
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural andEducational Rights Right to Constitutional Remedies Directive Principles of State PolicyFundamental Duties.	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and FunctionsExecutive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges,Qualifications Powers and Functions	4
5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative,CE of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4

TEXT BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition,2015.

REFERENCES:

1. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

I Year - II Semester	Deep Learning	L	T	P	C
		3	0	0	3

Course Objectives:

- The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short-term memorycells and convolutional neural networks.
- The course also requires students to implement programming assignments related to these topics.
- To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.

Course Outcomes: At the end of the course, students should be able to:

CO-1: understand the structure and function of biological neurons and their role in information processing

CO-2: to explore Deep learning techniques and various feature extraction strategies.

CO-3: to mathematically understand the deep learning approaches and paradigms

CO-4: to apply the deep learning techniques for various applications

CO-5: select appropriately from a range of techniques when implementing intelligent systems.

UNIT I:

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

UNIT II:

Feedforward Networks- Multilayer Perceptron, Gradient Descent,Backpropagation, Empirical Risk Minimization, regularization, autoencoders.

Deep Neural Networks: Difficulty of training deep neural networks, Greedy layerwise training.

UNIT III:

Better Training of Neural Networks- Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT IV:

Recurrent Neural Networks- Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs

Convolutional Neural Networks: LeNet, AlexNet.

Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

UNIT V: Recent trends- Variational Autoencoders, Generative Adversarial Networks,Multi-task Deep Learning, Multi-view Deep Learning
Applications: Vision, NLP, Speech (just an overview of different applications in 2-3 lectures)

TEXTBOOKS

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. https://archive.nptel.ac.in/courses/106/106/106106184/

I Year - II Semester	Big Data Analytics	L	T	P	C
		3	0	0	3

Course Objectives

- The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
- This course is also designed to give an exposure of the frontiers of Big data Analytics

Courses Outcomes: At the end of the course, students should be able to:
CO-1: ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
CO-2: ability to program using HADOOP and Map reduce, NOSQL
CO-3: ability to understand the importance of Big Data in Social Media and Mining.
CO-4: understand Big Data and its analytics in the real world.
CO-5: implement Big Data Activities using Hive

UNIT - I
Getting an Overview of Big Data: What is Big Data? History of Data Management – Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-Memory Computing Technology for Big Data.

UNIT - II
Understanding Hadoop Ecosystem: Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Hadoop YARN, Hbase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie Understanding MapReduce Fundamentals and Hbase: The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing

UNIT - III
Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Points to Consider during Analysis, Developing an Analytic Team, Understanding Text Analytics Analytical Approaches and Tools to Analyze Data: Analytical Approaches, History of Analytical Tools. Introduction to Popular Analytical Tools, Comparing Various Analytical Tools, Installing R

UNIT - IV
Data Visualization-I: Introducing Data Visualization, Techniques Used for Visual Data Representation, Types of Data Visualization, Applications of Data Visualization, Visualizing Big Data, Tools Used in Data Visualization, Tableau Products Data Visualization with Tableau (Data Visualization-II): Introduction to Tableau Software, Tableau Desktop Workspace, Data Analytics in Tableau Public, Using Visual Controls in Tableau Public

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media, Introducing Key Elements of Social Media, Introducing Text Mining, Understanding Text Mining Process, Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets

Mobile Analytics: Introducing Mobile Analytics, Introducing Mobile Analytics Tools, Performing Mobile Analytics, Challenges of Mobile Analytics

TEXT BOOKS:

1. Big data, blackbook, dreamtech press,2015
2. Big Data Analytics, SeemaAcharya, Subhashini Chellappan, Wiley 2015.
3. Simon Walkowiak, Big Data Analytics with R, Packt Publishing, ISBN: 9781786466457

REFERENCES:

1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiley CIO Series, 2013.
2. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.
3. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBMCorporation,2012.

Online Resources:

1. https://nptel.ac.in/courses/106104189
2. https://nptel.ac.in/courses/106106142

I Year - II Semester	PE-III: Artificial Neural Networks	L	T	P	C
		3	0	0	3

Course Objective:

- The main objective of this course is to provide the student with the basic understanding ofneural networks fundamentals,
- Program the related algorithms and design the required and related systems

CourseOutcomes: At the end of the course, students should be able to:
CO-1: demonstrate ANN structure and activation Functions
CO-2: define foundations and learning mechanisms and state-space concepts
CO-3: identify structure and learning of perceptions
CO-4: explain Feed forward, multi-layer feed forward networks and Back propagation algorithms
CO-5: analyze Radial Basis Function Networks, Theor Regularization and RBF networks

UNIT-I:
Introduction and ANN Structure, Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures.

UNIT-II:
Mathematical Foundations and Learning mechanisms. Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning. Memorybased learning, Hebbian learning. Competitive learning.

UNIT-III:
Single layer perceptrons, Structure and learning of perceptrons, Pattern classifier, introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence. Limitations of a perceptrons.

UNIT-IV:
Feed forward ANN, Structures of Multi-layer feed forward networks. Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation. Practical and design issues of back propagation learning.

UNIT-V:
Radial Basis Function Networks, Pattern separability and interpolation, Regularization Theor Regularization and RBF networks.RBF network design and training. Approximation properties of RBF.

TEXT BOOKS:

1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997

Online Resources:

1. https://nptelvideos.com/video.php?id=511
2. https://nptel.ac.in/courses/117105084

I Year - II Semester	PE-3: Soft Computing	L	T	P	C
		3	0	0	3

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logictheory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective

Course Outcomes: At the end of the course, students should be able to

CO-1: comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.

CO-2: understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic

CO-3: to understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations

CO-4: understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications

CO-5: reveal different applications of these models to solve engineering and other problems.

UNIT-I:

Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If- Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Surgeon Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

UNIT-II:

Optimization: Derivative based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing and Random Search – Downhill Simplex Search.

UNIT-III:

Artificial Intelligence: Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent directed Search Production System and Learning.

UNIT-IV:

Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Architecture – Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT-V:

Applications Of Computational Intelligence: Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.

Text Books:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems",Oxford University Press, 2006.

Reference Books:

1. Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

Online Resources:

1. https://archive.nptel.ac.in/courses/127/105/127105006/
2. https://archive.nptel.ac.in/courses/106/105/106105173/

I Year - II Semester	PE-3: Enterprise Cloud Concepts	L	T	P	C
		3	0	0	3

Course Objectives:

- Knowledge on significance of cloud computing and its fundamental concepts and models.

Course Outcomes: At the end of the course, students should be able to
CO-1: understand importance of cloud architecture
CO-2: illustrating the fundamental concepts of cloud security
CO-3: analyze various cloud computing mechanisms
CO-4: understanding the architecture and working of cloud computing.
CO-5: analyze various cloud programming models and apply them to solve problems on the cloud.

UNIT - I
Understanding Cloud Computing: Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges.
Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

UNIT - II
Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology.
Cloud Computing Mechanisms: Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication.

UNIT - III
Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example
Cloud Computing Architecture
Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example

UNIT - IV
Cloud-Enabled Smart Enterprises: Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, the Enabling Mechanisms of Smart Enterprises Cloud-Inspired Enterprise Transformations: Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy

UNIT - V

Transitioning to Cloud-Centric Enterprises: The Tuning Methodology, Contract Management in the Cloud, Cloud-Instigated IT Transformations Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds.

TEXT BOOKS:

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition,
2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press

REFERENCES:

1. James Bond,The Enterprise Cloud, O'Reilly Media, Inc.

Online Resources:

1. https://nptel.ac.in/courses/106105223
2. https://archive.nptel.ac.in/courses/106/105/106105223/

I Year - II Semester	PE-: 4 Natural Language Processing	L	T	P	C
		3	0	0	3

Course Objectives:

- Develop competency to use the Python programming language.
- Develop an appreciation for structures in natural language which computers are confronted with when processing natural language.
- Learn various techniques under Natural Language Processing (NLP) to solve language processing problems.
- Introduce frontier areas in NLP research.

Course Outcomes: At the end of the course, students should be able to
CO-1: demonstrate a given text with basic Language features
CO-2: to design an innovative application using NLP components
CO-3: explain a rule-based system to tackle morphology/syntax of a language
CO-4: to design a tag set to be used for statistical processing for real-time applications
CO-5: to compare and contrast the use of different statistical approaches fordifferent types of NLP applications.

UNIT I:
INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar- based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II:
WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III:
SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

UNIT IV:
SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm– Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, Word Net, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TEXT BOOKS:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2 Edition, Daniel Jurafsky, James H. Martin - Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009

REFERENCE BOOKS:

1. Language Processing with Java and Ling Pipe Cookbook, 1Atlantic Publisher, 2015.
2. Handbook of Natural Language Processing, Second, Nitin Indurkhya and Fred J. Damerau,Chapman and Hall/CRC Press, 2010.Edition
3. Natural Language Processing and Information Retrieval, 3Tiwary, Oxford University Press, 2008.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. https://archive.nptel.ac.in/courses/106/106/106106211/

I Year - II Semester	PE-4: Principles Of Cyber Security	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn threats and risks within context of the cyber security architecture.
- Student should learn and Identify security tools and hardening techniques.
- To learn types of incidents including categories, responses and timelines for response.

Course Outcomes: At the end of the course, student should be able to

CO-1: apply cyber security architecture principles.
CO-2: describe risk management processes and practices.
CO-3: appraise cyber security incidents to apply appropriate response
CO-4: distinguish system and application security threats and vulnerabilities.
CO-5: identify security tools and hardening techniques

UNIT–I:

Introduction to Cyber security- Cyber security objectives**,** Cyber security roles**,** Differences between Information Security & Cyber security, **Cyber security Principles-** Confidentiality, integrity, &availability Authentication & non- repudiation.

UNIT–II:

Information Security (IS) within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts, **Risks & Vulnerabilities-**Basics of risk management**,** Operational threat environments**,** Classes of attacks.

UNIT–III:

Incident Response- Incident categories**,** Incident response Incident recovery, and **Operational security protection**: Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management.

UNIT–IV:

Threat Detection and Evaluation (DE): Monitoring- Vulnerability Management, Security Logs and Alerts, Monitoring Tools and Appliances**.Analysis-** Network traffic Analysis, packet capture and analysis

UNIT–V: Introduction to backdoor System and security-Introduction to metasploit, Backdoor, demilitarized zone(DMZ),Digital Signature, Brief study on Harding of operating system.

TEXT BOOKS:

1. NASSCOM: Security Analyst Student Hand Book Dec 2015.
2. Information Security Management Principles Updated Edition by David Alexander, Amanda Finch, and David Sutton, Published by BCS, June 2013.

REFERENCE BOOKS:

1. CSX- cyber security fundamentals 2nd edition, Published by ISACA,Cyber security, Network Security, Data Governance Security.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://onlinecourses.swayam2.ac.in/nou21_ge40/preview

I Year - II Semester	PE-4: Social Network Analytics	L	T	P	C
		3	0	0	3

Course Objectives:

- The learning objective of the course Social Network Analysis is to provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

Course Outcomes: After the completion of the course, student will be able to
CO-1: demonstrate social network analysis and measures.
CO-2: analyze random graph models and navigate social networks data
CO-3: apply the network topology and Visualization tools.
CO-4: analyze the experiment with small world models and clustering models.
CO-5: compare the application driven virtual communities from social network Structure.

UNIT I:

Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance andHomophily.

UNIT II:
Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, rolesand positions.

UNIT III:
Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

UNIT IV:
Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models.

UNIT V:
Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, networkformation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

Text Books:

1. S. Wasserman and K. Faust. Social Network Analysis: Methods and Applications (Cambridge, Cambridge University Press, 1994)
2. D. Easley and J. Kleinberg, Networks, Crowds and Markets: Reasoning about a highly connected world

Reference Books:

1. Social Network Data Analytics, Aggarwal, Charu C. (Ed.), Springer Publisher, 2011

Online Resources:

1. https://archive.nptel.ac.in/courses/106/106/106106239/
2. https://onlinecourses.nptel.ac.in/noc22_cs117/preview

I Year - II Semester	Big Data Analytics Lab	L	T	P	C
		3	0	0	3

Course Objectives:

- The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
- This course is also designed to give an exposure of the frontiers of Big data Analytics

Course Outcomes: At the end of the course, students should be able to:
CO-1: use Excel as an Analytical tool and visualization tool.
CO-2: ability to program using HADOOP and Map reduce
CO-3: ability to perform data analytics using ML in R.
CO-4: use cassandra to perform social media analytics
CO-5: analyze the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics

List of Experiments:
1. Implement a simple map-reduce job that builds an inverted index on the set of input documents (Hadoop)
2. Process big data in HBase
3. Store and retrieve data in Pig
4. Perform Social media analysis using cassandra
5. Buyer event analytics using Cassandra on suitable product sales data.
6. Using Power Pivot (Excel) Perform the following on any dataset
a) Big Data Analytics
b) Big Data Charting
7. Use R-Project to carry out statistical analysis of big data
8. Use R-Project for data visualization of social media data

TEXT BOOKS:

1. Big Data Analytics, SeemaAcharya, Subhashini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

REFERENCES:

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.

3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al., McGraw Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with AdvancedAnalytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

Online Resources:

1. https://nptel.ac.in/courses/106104189
2. https://nptel.ac.in/courses/106106142

I Year - II Semester	Deep Learning Lab	L	T	P	C
		0	0	2	2

Course Objectives:

From the course the student will learn

- Describe supervised and unsupervised learning differences.
- Describe the data science life cycle.
- Use machine Take data science into production.
- Introducing data science, with a focus on the job outlookand market Requirements.
- Hands-on Applied Statistics Concepts using Python.
- Graphics and Data Visualization Libraries in Python.
- Machine Learning algorithms, Models and Case Studies with Python.

Course Outcomes: At the end of the course, students should be able to

CO-1: use Deep Learning techniques to build concise representations of the meanings of words in all significant languages
CO-2: use Voice Recognition application using
CO-3: develop a feed forward, convolution and recurrent neural networks.
CO-4: experiment with AI and data visualization techniques
CO-5: examine Object Recognition application

Get Familiarity with popular deep learning frame works such as Tensor Flow, PyTorch, Keras, etc.. For applications like

Experiments

1. Implement Face Recognition application using any one of frame works
2. Implement Voice Recognition application using any one of frame works
3. Implement Object Recognition application using any one of frame works
4. Implement Object Counting application using any one of frame works
5. Implement Sentiment Analysis application using any one of frame works
6. Implement Detection of Fake News application using any one of frame works, etc….

TEXTBOOKS

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. https://archive.nptel.ac.in/courses/106/106/106106184/

AC: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Understand that how to improve your writing skills and level of readability Learn about what to write in each section Understand the skills needed when writing a Title Ensure the good quality of paper at very first- time submission

Course Outcomes:

CO-1: ability to plan and prepare written content, organizing ideas logically before drafting.

CO-2: effectively clarify and articulate who contributed to specific ideas or findings in their writing, enhancing transparency in academic discourse

CO-3: effectively present and organize research results, using tables, figures, and descriptive statistics to enhance clarity and understanding.

CO-4: learn to write clear and succinct abstracts that summarize the research purpose, methodology, key findings, and significance, allowing readers to quickly grasp the essence of the study.

CO-5: develop the ability to clearly describe research methodologies, including design, sampling, data collection, and analysis techniques, enabling replication and validation of their study.

Syllabus		
UNITS	**CONTENTS**	**Hours**
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion,Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing theResults, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possiblybe the first- time submission	4

TEXTBOOKS:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress

REFERENCE BOOKS:

1. Highman N (1998), Handbook of Writing for the MathematicalSciences, SIAM. Highman'sbook.
2. Adrian Wallwork , English for Writing Research Papers, Springer New YorkDordrecht Heidelberg London,2011

AC: DISASTER MANAGEMENT

Course Objectives:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practicalrelevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Course Outcomes:

CO-1: to define what constitutes a disaster and explain its significance in terms of societal impact and response

CO-2: analyze the economic, social, and environmental repercussions of disasters, including economic damage, loss of human and animal life, and ecosystem destruction.

CO-3: identify and describe regions in India that are particularly vulnerable to various disasters, including seismic zones, flood-prone areas, and drought-affected regions.

CO-4: develop skills to evaluate disaster risks effectively, incorporating data analysis and interpretation to assess potential impacts on communities

CO-5: learn various techniques for conducting risk assessments, including qualitative and quantitative methods, hazard mapping, and vulnerability analysis.

Syllabus		
Units	**CONTENTS**	**Hours**
1	**Introduction:** Disaster: Definition, Factors and Significance; Difference Between Hazard andDisaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	4
2	**Repercussions of Disasters and Hazards**: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. **Natural Disasters:** Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man- made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.	4
3	**Disaster Prone Areas in India** Study Of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics	4
4	**Disaster Preparedness and Management:** Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.	4
5	**Risk Assessment:** Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation In Risk Assessment. Strategies for Survival.	4

6	**Disaster Mitigation:** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation,Programs of Disaster Mitigation In India.	4

TEXTBOOKS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies"'New Royal bookBCompany.

REFERENCE BOOKS:

1.Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, NewDelhi.
2. Goel S. L. , Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., NewDelhi.

AC: STRESS MANAGEMENT BY YOGACOURSE

Course Objectives

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: At the end of the course, students should be able to:

CO-1: develop healthy mind in a healthy body thus improving social health also
CO-2: improve efficiency

Unit	Content	Hours
1	Definitions of Eight parts of yog. (Ashtanga)	5
2	Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha	5
3	Yam and Niyam. Do`s and Don't's in life. Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	5
4	Asan and Pranayam Various yog poses and their benefits for mind & body	5
5	Regularization of breathing techniques and its effects-Types of pranayam	4

TEXT BOOKS:

1. 'Yogic Asanas for Group Training-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by SwamiVivekananda, Advaita Ashrama (Publication Department), Kolkata

AC: PERSONALITY DEVELOPMENT THROUGHLIFE ENLIGHTENMENT SKILLS

Course Objectives

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: At the end of the course, students should be able to

CO-1: Study of Shrimad-Bhagwad-Geeta will help the student in developing hispersonality and achieve the highest goal inlife

CO-2: The person who has studied Geeta will lead the nation and mankind to peace andprosperity

CO-3: Study of Neetishatakam will help in developing versatile personality ofstudents

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personalityVerses-19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism)Verses-26,28,63,65 (virtue)	4
2	Neetisatakam-Holistic development of personalityVerses- 52,53,59 (dont's) Verses- 71,73,75,78 (do's)	4
3	Approach to day-to-day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,	4
4	Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	4
5	Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18	4
6	Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17,Chapter 3-Verses36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	4

TEXT BOOKS:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya SanskritSansthanam, NewDelhi.

II Year - I Semester	PE-5: Machine Translation	L	T	P	C
		3	0	0	3

Course Objectives:

- To teach students machine translation approaches.
- To evaluate the performance of machine translation Systems.
- To develop translation models for Indian Languages.

Course Outcomes: At the end of the course, students should be able to
CO-1: understand machine translation approaches.
CO-2: apply and assess manual and automatic evaluation methods for machine translation.
CO-3: build machine translation model using existing tools for machine translation.
CO-4: understand Word-based Statistical Machine Translation
CO-5: understand Neural Translation Model

UNIT - I
Introduction to Machine Translation, MT Approaches: vauquois Triangle, Three major paradigms of Machine Translation, MT Evaluation

UNIT - II
Learning Bilingual word Mappings: A Combinatorial Argument, Deeper look at one- one alignment, Heuristic based Computation of the VE *VF Table, Iterative Computation of the VE *VF Table, EM: Study of progress in Parameter values

UNIT - III
Phrase based Machine Translation: Need for phrase alignment, An example to illustrate phrase alignment technique, Phrase table, Mathematics of Phrase based SMT, Decoding, Moses.

UNIT - IV
Rule based Machine Translation (RBMT): Two kinds of RBMT: Interlingua and Transfer, Universal networking Language (UNL), UNL expressions as binary predicates, Interlingua and Word Knowledge, Translation using Interlingua, Details of english to UNL Conversion: with illustration, Transfer based MT.

UNIT - V
Example based Machine Translation: Essential steps of EBMT, EBMTs working, EBMT and case based reasoning, Text similarity computation, EBMT and Translation Memory, EBMT and SMT.

TEXT BOOK:
1. Pushpak Bhattacharyya, Machine Translation, CRC Press

REFERENCES:

1. Statistical Machine Translation by Philipp Koehn, Cambridge University Press.
2. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
3. Linguistic Fundamentals for Natural Language Processing by Emily Bender, Morgan & Claypool.

Online Resources:

1. https://www.youtube.com/watch?v=29j6TzCFgDY
2. https://onlinecourses.nptel.ac.in/noc23_hs87/preview

II Year - I Semester	PE-5: Computer Vision	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the basic concepts and techniques in computer vision, including image processing, feature extraction, and object recognition
- Learn and apply various image processing techniques, such as filtering, edge detection, and image segmentation

Course Outcomes: At the end of the course, students should be able to

CO-1: provide an introduction to computer vision including fundamentals of image formation
CO-2: enumerate the concepts of Feature detection and Matching
CO-3: discuss about Image Segmentation Techniques
CO-4: discuss applications of Feature based alignment like pose estimation
CO-5: discuss different recognition techniques.

UNIT-I:
Introduction: What is computer vision, A brief history, Image Formation, Geometric primitives and transformations, Photometric image formation, The digital camera.

UNIT-II:
Feature detection and matching: Points and patches, Feature detectors, Feature descriptors, Feature matching, Feature tracking, Application: Performance-driven animation, Edges, Application: Edge editing and enhancement, Lines, Application: Rectangle detection.

UNIT-III:
Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods, Application: Medical image segmentation.

UNIT-IV:
Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration, Calibration patterns, Vanishing points, Application: Single view metrology, Rotational motion, Radial distortion.

UNIT-V:
Recognition: Objectdetection,Face detection, Pedestrian detection, Face recognition,Eigenfaces, Active appearance and 3D shape models, Application: Personal photo collections, Instance recognition, Category recognition, Context and scene understanding.

TEXT BOOKS:
1. Richard Szeliski,"Computer Vision: Algorithms and Applications", Springer, 2010.
2. Rafael C. Gonzalez "Digital Image processing", Pearson Education; Fourth edition (2018).

REFERENCE BOOKS:

1. Forsyth/Ponce, "Computer Vision: A Modern Approach", Pearson Education India; 2nd edition(2015)
2. S.Nagabhushana,"Computer Vision and Image processing ", New Age International Pvt Ltd; First edition (2005)

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs93/preview
3. https://onlinecourses.nptel.ac.in/noc23_ee39/preview

II Year - I Semester	PE-5: Robotics And Intelligent Systems	L	T	P	C
		3	0	3	3

Course Objectives:

- Understand the basic concepts and components of robotic systems, including sensors, actuators, and control systems
- Learn the principles of kinematics and dynamics as they apply to robotic motion and manipulation, including forward and inverse kinematics.
- Explore various control strategies for robots, including PID control, adaptive control, and model predictive control

Course Outcomes: At the end of the course, students should be able to
CO-1: enumerate the fundamentals of robotics and Artificial Intelligence (AI).
CO-2: demonstrate how to setting up a robot.
CO-3: discuss about the practical Robot Design Process.
CO-4: discuss Object Recognition Using Neural Networks and Supervised Learning
CO-□□ able to get or extend your skills in programming and hardware design including VHDL/FPGA.

UNIT-I:
Foundation for Advanced Robotics and AI: The basic principle of robotics and AI, What is AI and what is it not, The example problem, Artificial intelligence and advanced robotics techniques, Introducing the robot and our development environment, Software components (ROS, Python, and Linux), Robot control systems and a decision-making framework, The robot control system – a control loop with soft real-time control

UNIT-II:
Setting Up Your Robot: Technical requirements, What is a robot, Robot anatomy, Subsumption architecture, Software setup, Hardware, Assembling the tracks,Mounting the tracks, Arm base assembly, Wiring.

UNIT-III:
A Concept for a Practical Robot Design Process, A systems engineering-based approach to robotics, Use cases, and the problem –put away the toys, Project goals, Decomposing hardware needs, breaking down software needs

UNIT-IV:
Object Recognition Using Neural Networks and Supervised Learning: Technical requirements, the image recognition process, the image recognition training and deployment process – step by step, the convolution neural network process, Build the toy/not toy detector

UNIT-V:
Picking up the Toys: Technical requirements, Task analysis, Summary of robot arm learning process, Teaching the robot arm, Version one – action state reinforcement learning, Adaptive learning rate, Q- learning implementation, Google's SAC-X, Amazon Robotics Challenge

Text Books:

1. Francis X. Govers, Artificial Intelligence for Robotics: Build intelligent robots that perform humantasks using AI techniques, PACKT
2. J. J. Craig, Introduction to Robotics, Addison Wesley Publishers, 2005

Reference Books:

1. M. Negnevitsky, Artificial Intelligence – A guide to intelligent systems Addison-Wesley,2005

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_me76/preview
2. https://nptel.ac.in/courses/112107289

II Year - I Semester	OE-1 Internet Of Things	L	T	P	C
		3	0	0	3

Course Objectives:

- Grasp the basic concepts and architecture of IoT, including devices, connectivity, and cloud computing.
- Learn about the various communication protocols and standards used in IoT, such as MQTT, CoAP, and HTTP, and their applications

Course Outcomes (COs): At the end of the course, student will be able to

CO-1: explain in a concise manner how the general Internet as well as Internet of Things work.
CO-2: understand constraints and opportunities of wireless and mobile networks for Internet of Things.
CO-3: use basic sensing and measurement and tools to determine the real-timeperformance of network of devices.
CO-4: develop prototype models for various applications using IoT technology
CO-5: able to understand building blocks of Internet of Things and characteristics.

UNIT I:
The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT II:
Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III:
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices

UNIT IV:
Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw HillHigher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2. https://onlinecourses.swayam2.ac.in/ntr24_ed01/preview

II Year - I Semester	OE-1: Recommender Systems	L	T	P	C
		3	0	0	3

Course Objectives:

- This course covers the basic concepts of recommender systems, including personalizationalgorithms, evaluation tools, and user experiences

Course Outcomes: At the end of the course, students should be able to

CO-1: describe basic concepts behind recommender systems

CO-2: explain a variety of approaches for building recommender systems

CO-3: describe system evaluation methods from both algorithmic and users' perspectives

CO-4: describe applications of recommender systems in various domains

CO-5: familiarize with recommender systems and their applications

UNIT-I:

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings,Applications of recommendation systems, Issues with recommender system

UNIT-II:

Collaborative Filtering: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

UNIT-III:

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders

UNIT-IV:

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT-V:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics,

User-Centred metrics. **Recommender Systems and communities:** Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations.

Text Books:

1. Jannach D., Zanker M. andFelFering A., Recommender Systems: An Introduction, CambridgeUniversity Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011),1sted.

References:

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems ForLearning, Springer(2013), 1st ed.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ge35/preview#:~:text=Recommender%20systems%20discover%20information%20items,things%20he%20has%20never%20experienced.
2. http://www.digimat.in/nptel/courses/video/127105390/L31.html