GENERAL MINOR TRACKS

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20CCMN04	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	3	1	0	4
2	R20CCMN39	FUNDAMENTALS OF DATA SCIENCE	3	1	0	4
3	R20CCMN40	FUNDAMENTALS OF MACHINE LEARNING	3	1	0	4
4	R20CCMN41	FUNDAMENTALS OF DEEP LEARNING	3	1	0	4
5	R20CCMN42	INTRODUCTION TO BIG DATA ANALYTICS	3	1	0	4
	In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering					

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN04	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**						

COURSE OBJECTIVE:

Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic and learning.

• The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]

CO2: Analyse different search techniques and predicate logic in artificial Intelligence. [K4]

CO3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]

CO4: Apply the basic knowledge on learning and reinforcement learning. [K3]

CO5: Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]

SYLLABUS:

UNIT - I

Introduction to AI, Problems, agent, agent types ,Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems - advantages & disadvantages , features of production system, production system rules, classifications.

UNIT – II

Heuristic Search Techniques: Hill Climbing algorithm, problems, Best-First Search(greedy approach), A* search Algorithm Problem Reduction, Constraint Satisfaction

Knowledge Representation Using Predicate Logic: Representing Simple Facts in logic, Representing Instance and Isa Relationship.

UNIT - III

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning.

UNIT – IV

Learning: machine learning, types , Reinforcement Learning: Markov Decision Problem, Q-Learning, Q-Learning Algorithm

UNIT – V

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural language Processing, Spell Checking.

TEXT BOOKS:

1. Elaine Rich & Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Edition, 3rd Edition, Reprint 2008.

2. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,

3. Carl Townsend, "Introduction to TURBO PROLOG", BPB Publications. 2011 4. Tom M Mitchell, "Machine Learning", McGraw-Hill Science/Engineering/Math, 1997.

REFERENCE BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,

2. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003

3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003

WEB REFERENCES:

1. https://www.coursera.org/learn/machine-learning

2. https://www.simplilearn.com/big-data-and-analytics/machine-learning

3. https://www.appliedaicourse.com/course/applied-ai-course-online

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN39	**FUNDAMENTALS OF DATA SCIENCE**						

COURSE OBJECTIVE:

- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in Python
- To provide a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the real world

COURSE OUTCOMES:

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

CO 1: Demonstrate the basic arithmetic programming in python[K3]

CO 2: Analyze different data structures and choose suitable one for a given problem[K4]

CO 3: Demonstrate Data cleaning, processing for the given dataset using respective packages.[K3]

CO 4: Perform Data visualization[K3]

CO 5: Solve the problems related to Descriptive and Inferential Statistics for a given scenario.[K4]

SYLLABUS:

UNIT-I

What is Data science?, The Data science process, A data scientist role in this process, NumPy Basics: The NumPy ndarray: A Multidimensional Array Object(Creating ndarrays ,Data Types for ndarrays,Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, FancyIndexing), Data Processing Using Arrays(Expressing Conditional Logic as Array Operations ,Methods for Boolean Arrays , Sorting , Unique)

UNIT-II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures(Series, DataFrame, Index Objects), Essential Functionality(Reindexing, Dropping entries from an axis, Indexing, selection, and filtering), Sorting and ranking, Summarizing and Computing Descriptive Statistics(Unique Values, Value Counts), Handling Missing Data.

UNIT-III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format(Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats,

UNIT-IV

Data Wrangling: Clean, Transform, Merge, Reshape: Combining and Merging Data Sets (Database-style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap)

Plotting and Visualization: A Brief matplotlib API Primer (Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File), Plotting Functions in pandas (Line Plots, Bar Plots, Histograms, Scatter Plots)

UNIT-V

Data Aggregation and Group Operations: GroupBy Mechanics(Iterating Over Groups, Selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels) Data Aggregation(Column-wise and Multiple Function Application, Returning Aggregated Data in "unindexed" Form)

TEXT BOOKS:

Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN: 978-1-449-31979-3, 1st edition, October 2012.

REFERENCE BOOKS:

1. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

2. Joel Grus, "Data Science from Scratch", O'REILLY, 1st edition, April 2015

WEB REFERENCES:

https://www.greatlearning.in/

https://onlinecourses.nptel.ac.in/noc20_cs62/

https://nptel.ac.in/noc/courses/noc20/SEM2/noc2

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN40	**FUNDAMENTALS OF MACHINE LEARNING**						

COURSE OBJECTIVES:

- To understand how machine learning algorithms are evaluated.
- To be Familiar with a set of well-known supervised, unsupervised and semi-supervised learning algorithms.
- To be able to implement some basic machine learning algorithms.

COURSE OUTCOMES:

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

CO 1: Summarize the characteristics of Machine Learning that make it useful to real-world Problems. [K2]

CO 2: Outline the need and importance of pre-processing techniques and apply them. [K2]

CO 3: Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them. [K5]

CO 4: Analyze the performance of Association Rules. [K4]

CO 5: Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. [K5]

SYLLABUS

UNIT– I

Introduction: Definition of learning systems, Goals and applications of machine learning, training data, concept representation. Supervised Learning: Learning a Class from Examples, Vapnik Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning

UNIT–II

Bayesian Decision Theory: Classification, Losses and Risks, Parametric Methods: Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma

UNIT–III

Dimensionality Reduction: Subset Selection, Principal Components Analysis, Factor Analysis, Linear Discriminant Analysis Association learning: Basics of Association, Apriori Algorithm, Eclat Algorithm, FP Growth Algorithm with examples

UNIT-IV

Unsupervised Learning: Self-Organizing Maps(SOM),learning Process in SOM, Algorithm: SOM, Clustering: k-Means Clustering, Expectation-Maximization Algorithm, Supervised Learning after Clustering,
Fuzzy Clustering, Document Clustering example, Hierarchical Clustering

UNIT-V

Decision Trees: Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data. Random Forest: basic Principle, Decision Tree vs random Forest, Random Forest Algorithm with Example

TEXT BOOKS:

Ethem Alpaydin, "Introduction to Machine Learning", The MIT Press, 2010
Artificial Intelligence and Machine Learning, by Vinod Chandra PHI Learning.
Aurélien Géron, "Handson machine learning with scikit learn and tensorflow" O'REILLY

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN41	**FUNDAMENTALS OF DEEP LEARNING**						

COURSE OBJECTIVE:

• This course covers the basics of machine learning, neural networks and deep learning. Model for deep learning technique and the various optimization and generalization mechanisms are included. Major topics in deep learning and dimensionality reduction techniques are covered. The objective of this course is:

• To present the mathematical, statistical and computational challenges of building neural networks. • To study the concepts of deep learning

• To introduce dimensionality reduction techniques

• To enable the students to know deep learning techniques to support real-time applications

• To examine the case studies of deep learning techniques

COURSE OUTCOMES:

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

CO 1: Compare and Contrast concepts of deep learning[K2].

CO 2: Make use of various deep learning models[K3].

CO 3: Interpret Statistical reasoning and filler structures[K2].

CO 4: Analyze optimization and generalization in deep learning[K4].

CO 5: Analyze the deep learning applications[K4]

SYLLABUS:

UNIT-I

INTRODUCTION :Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT-II

DEEP NETWORKS History of Deep Learning- A Probabilistic Theory of Deep LearningBackpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning

UNIT-III

DIMENTIONALITY REDUCTION Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT-IV

OPTIMIZATION AND GENERALIZATION Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks

UNIT-V

RECURRENT NEURAL NETWORK Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

TEXT BOOKS:

1. Cosma Rohilla Shalizi, " Advanced Data Analysis from an Elementary Point of View", 2015.

2. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.

3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

4. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN42	**FUNDAMENTALS OF BIG DATA ANALYTICS**						

COURSE OBJECTIVES:

- Introducing Java concepts required for developing map reduce programs.
- Optimize business decisions and create competitive advantage with Big Data analytics.
- Derive business benefit from unstructured data.
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

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

CO 1: Interpret the architectural elements of big data and Hadoop framework. [K2]

CO 2: Analyse various big data applications using map reduce programming module. [K4]

CO 3: Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4]

CO 4: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2]

CO 5: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]

SYLLABUS:

UNIT– I

Starting Hadoop: -Google File System, -The building blocks of Hadoop: Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker. -Setting up SSH for a Hadoop cluster: Define a common account, Verify SSH installation, Generate SSH key pair, Distribute public key and validate logins. - Running Hadoop: Local (standalone) mode, Pseudo-distributed mode, Fully distributed mode.

UNIT–II

MapReduce: -A Weather Dataset: Data Format, -Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce: A test run, The old and the new Java MapReduce APIs. Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

UNIT–III

Programming with RDDs: What Is Apache Spark, RDD Basics, Creating RDDs, RDD Operations, Passing Functions to Spark, Common Transformations and Actions, Persistence (Caching).

UNIT-IV

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

UNIT-V

Applying Structure to Hadoop Data with Hive: -Saying Hello to Hive, -Seeing How the Hive is Put Together, -Getting Started with Apache Hive, -Examining the Hive Clients: The Hive CLI client, The web browser as Hive client, SQuirreL as Hive client with the JDBC Driver. - Working with Hive Data Types, -Creating and Managing Databases and Tables: Managing Hive databases, Creating and managing tables with Hive. -Seeing How the Hive Data Manipulation Language Works: LOAD DATA examples, INSERT examples, Create Table As Select (CTAS) examples. Querying and Analyzing Data: Joining tables with Hive, Improving your Hive queries with indexes, Windowing in HiveQL, Other key HiveQL features.

TEXT BOOKS:

1. Tom White, “Hadoop: The Definitive Guide” 3rd Edition, O’Reilly Media.

2. Matei Zaharia, Holden Karau, Andi Konwinski, Patric Wendell, Learning Spark, O’Reilly Media,2015.

3. by Chuck Lam, “Hadoop in Action” MANNING Publ.

4. Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss, “Hadoop for Dummies”

REFERENCE BOOKS:

1. Alex Holmes, “Hadoop in Practice”, MANNING Publ.

2. Srinath Perera, “Hadoop MapReduce Cookbook”, Thilina Gunarathne

WEB REFERENCES:

1. https://www.edx.org/learn/big-data

2. https://www.edureka.co/big-data-and-hadoop