R18 B.TECH. MINOR IN AIML (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Foundations of AI (3 credits)	AI Lab (1.5 credits)	4.5
2.	III - II Semester	AI Applications (4 credits)	----	4.0
3.	IV - I Semester	Machine Learning/ Deep Learning/ MOOCS (3 credits)	Machine Learning/ Deep Learning Lab (1.5 credits)	4.5
4.	IV - II Semester	**Elective any ONE of the following subjects** (3 credits)**:** 1. Robotics Process Automation 2. Natural Language Processing 3. Game theory 4. Computer Vision & Robotics 5. Speech & Video Processing 6. Soft Computing	----	3.0
5.	IV - II semester	Mini Project	---	2.0
			Total credits	**18.0**

MACHINE LEARNING

L	T	P	C
3	0	0	3

Prerequisites:

1. Data Structures
2. Knowledge on statistical methods

Course Objectives:

1. This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
2. To understand computational learning theory.
3. To study the pattern comparison techniques.

Course Outcomes:

1. Understand the concepts of computational intelligence like machine learning
2. Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
3. Understand the Neural Networks and its usage in machine learning application.

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning, Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, k-nearest neighbor algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.
Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.
Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.
Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOK:

1. Machine Learning – Tom M. Mitchell, - MGH.

REFERENCE BOOK:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

DEEP LEARNING

L	T	P	C
3	0	0	3

Course Objectives: students will be able

1. To understand complexity of Deep Learning algorithms and their limitations
2. To be capable of performing experiments in Deep Learning using real-world data.

Course Outcomes:

1. Implement deep learning algorithms, understand neural networks and traverse the layers of data
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Understand applications of Deep Learning to Computer Vision
4. Understand and analyze Applications of Deep Learning to NLP

UNIT- I

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT- II

Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT- III

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT- IV

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity

UNIT -V

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCE BOOKS:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

MACHINE LEARNING LAB

L	T	P	C
0	0	3	1.5

Course Objective:

1. The objective of this lab is to get an overview of the various machine learning
2. Techniques and can demonstrate them using python.

Course Outcomes:

1. After the completion of the course the student can able to:
2. Understand complexity of Machine Learning algorithms and their limitations;
3. Understand modern notions in data analysis-oriented computing;
4. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
5. Be capable of performing experiments in Machine Learning using real-world data.

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)

2. Extract the data from database using python

3. Implement k-nearest neighbors classification using python

4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k- means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no -> highRisk
high golf trading married forties yes -> lowRisk
low speedway transport married thirties yes -> medRisk
medium football banking single thirties yes -> lowRisk
high flying media married fifties yes -> highRisk
low football security single twenties no -> medRisk
medium golf media single thirties yes -> medRisk
medium golf transport married forties yes -> lowRisk
high skiing banking single thirties yes -> highRisk
low golf unemployed married forties yes -> highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.

7. Implement Naïve Bayes theorem to classify the English text

8. Implement an algorithm to demonstrate the significance of genetic algorithm

9. Implement the finite words classification system using Back-propagation algorithm

TEXT BOOK:

1. Machine Learning – Tom M. Mitchell, - MGH.

REFERENCE BOOK:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

DEEP LEARNING LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To Build the Foundation of Deep Learning.
2. To Understand How to Build the Neural Network.
3. To enable students to develop successful machine learning concepts.

Course Outcomes:

1. Upon the Successful Completion of the Course, the Students would be able to:
2. Learn the Fundamental Principles of Deep Learning.
3. Identify the Deep Learning Algorithms for Various Types of Learning Tasks in various domains.
4. Implement Deep Learning Algorithms and Solve Real-world problems.

LIST OF EXPERIMENTS:

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification on MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
7. Applying the Autoencoder algorithms for encoding the real-world data
8. Applying Generative Adversial Networks for image generation and unsupervised tasks.

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCE BOOKS:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Extensive Reading:

- http://www.deeplearning.net
- https://www.deeplearningbook.org/
- https://developers.google.com/machine-learning/crash-course/ml-intro
- www.cs.toronto.edu/~fritz/absps/imagenet.pdf
- http://neuralnetworksanddeeplearning.com/

R18 B.TECH. MINOR IN CYBER SECURITY (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Principles of Information Security (3 credits)	Principles of Information Security Lab (1.5 credits)	4.5
2.	III - II Semester	Foundations of Cyber Security (4 credits)	----	4.0
3.	IV - I Semester	Ethical Hacking/ Digital Forensics/ MOOCS (3 credits)	Ethical Hacking Lab/ Digital Forensics Lab (1.5 credits)	4.5
4.	IV - II Semester	**Elective any ONE of the following subjects** (3 credits)**:** 1. Security Incident & Response Management 2. Mobile Security 3. IoT Security 4. Blockchain Technologies 5. Authentication Techniques 6. Cloud Security	----	3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

ETHICAL HACKING

L	T	P	C
3	0	0	3

Prerequisites:

1. A course on “Operating Systems”.
2. A course on “Computer Networks”.
3. A course on “Network Security and Cryptography”.

Course Objectives:

1. The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing security.
2. The course includes-Impacts of Hacking; Types of Hackers; Information Security Models;
3. Information Security Program; Business Perspective; Planning a Controlled Attack; Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Course Outcomes:

1. Gain the knowledge of the use and availability of tools to support an ethical hack
2. Gain the knowledge of interpreting the results of a controlled attack
3. Understand the role of politics, inherent and imposed limitations and metrics for planning of a test
4. Comprehend the dangers associated with penetration testing

UNIT- I

Introduction: Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration

Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture

Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT - II

The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement

UNIT - III

Preparing for a Hack: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance

UNIT - IV

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase

Exploitation: Intuitive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern

UNIT - V

Deliverable: The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation

Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion

TEXT BOOK:

1. James S. Tiller, “The Ethical Hack: A Framework for Business Value Penetration Testing”, Auerbach Publications, CRC Press.

REFERENCE BOOKS:

1. EC-Council, “Ethical Hacking and Countermeasures Attack Phases”, Cengage Learning.
2. Michael Simpson, Kent Backman, James Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning.

DIGITAL FORENSICS

L	T	P	C
3	0	0	3

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:

1. provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: On completion of the course the student should be able to

1. Understand relevant legislation and codes of ethics.
2. Computer forensics and digital detective and various processes, policies and procedures.
3. E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Email and web forensics and network forensics.

UNIT - I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

UNIT - II

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT - III

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT - IV

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics, workstations and software, Conduct an investigation, Complete a case, Critique a case,
Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V

Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

TEXT BOOKS:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

REFERENCE BOOKS

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

ETHICAL HACKING LAB

L	T	P	C
0	0	3	1.5

Course Objectives

- The aim of the course is to introduce the methodologies framework tools of ethical hacking to get awareness in enhancing the security
- To get knowledge on various attacks and their detection

Course Outcomes

- Gain the knowledge of the use and availability of tools to support an ethical hack
- Gain the knowledge of interpreting the results of a controlled attack

List of Experiments:

1. Set Up a honey pot and monitor the honey pot on network
2. Write a script or code to demonstrate SQL injection attacks
3. Create a social networking website login page using phishing techniques
4. Write a code to demonstrate DoS attacks
5. Install rootkits and study variety of options
6. Study of Techniques uses for Web Based Password Capturing.
7. Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security And Management
8. Implement Passive scanning, active scanning, session hijacking, cookies extraction using Burp suit tool

DIGITAL FORENSICS LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To provide students with a comprehensive overview of collecting, investigating, preserving, and presenting evidence of cybercrime left in digital storage devices, emails, browsers, mobile devices using different Forensics tools.
2. To Understand file system basics and where hidden files may lie on the disk, as well as how to extract the data and preserve it for analysis.
3. Understand some of the tools of e-discovery.
4. To understand the network analysis, Registry analysis and analyze attacks using different forensics tools.

Course Outcomes:

1. Learn the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing
2. To Learn the file system storage mechanisms and retrieve files in hidden format
3. Learn the use of computer forensics tools used in data analysis.
4. Learn how to find data that may be clear or hidden on a computer disk, find the open ports for the attackers through network analysis, Registry analysis.

List of Experiments:

1. **Perform email analysis** using the tools like Exchange EDB viewer, MBOX viewer and View user mailboxes and public folders, Filter the mailbox data based on various criteria, Search for particular items in user mailboxes and public folders
2. **Perform Browser history analysis** and get the downloaded content, history saved logins, searches, websites visited etc using Foxton Forensics tool, Dumpzilla.
3. **Perform mobile analysis** in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT
4. **Perform Registry analysis** and get boot time logging using process monitor tool
5. **Perform Disk imaging and cloning the** using the X-way Forensics tools
6. **Perform Data Analysis i.e** History about open file and folder, and view folder actions using Listview activity tool
7. **Perform Network analysis** using the Network Miner tool**.**
8. **Perform information for incident response** using the crowd Response tool
9. **Perform File type detection using** Autopsy tool
10. **Perform Memory capture and analysis** using the Live RAM capture or any forensic tool

TEXT BOOKS:

1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerbach Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

REFERENCE BOOKS:

1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H. Malin, E. Casey and J. M. Aquilina, Syngress, 2012
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007.

R18 B.TECH. MINOR IN DATA SCIENCE (2021-22)

S. No.	Year/Semester	# Theory (Credits - 3)	# Labs (Credits - 1.5)	Total Credits
1.	III - I Semester	Introduction to Data Science (3 credits)	R Programming Lab (1.5 credits)	4.5
2.	III - II Semester	Data Science Applications (4 credits)	-----	4.0
3.	IV - I Semester	Data Wrangling and Visualization/ Big Data Analytics/ MOOCS (3 credits)	Data Wrangling and Visualization Lab/ Big Data Analytics Lab (1.5 credits)	4.5
4.	IV - II Semester	**Elective any ONE of the following subjects** (3 credits)**:** 1. Exploratory Data Analysis 2. Mining Massive Databases 3. Social Network Analysis 4. Predictive Analytics 5. Web & Social Media Analytics 6. Video Analytics	-----	3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

DATA WRANGLING AND DATA VISUALIZATION

L	T	P	C
3	0	0	3

Course Objectives:

- To learn data wrangling techniques
- To introduce visual perception and core skills for visual analysis

Course Outcomes: Upon completion of the course, the students will be able to:

- Perform data wrangling
- Explain principles of visual perception
- Apply core skills for visual analysis
- Apply visualization techniques for various data analysis tasks
- Evaluate visualization techniques

UNIT - I:

Data Wrangling: Need of data cleanup, data clean up basics – formatting, outliers, duplicates, Normalizing and standardizing data.

UNIT - II:

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT - III:

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

UNIT - IV:

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

UNIT - V:

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

TEXT BOOKS:

1. Jacqueline Kazil and Katharine Jarmul, Data Wrangling with Python: Tips and Tools to Make Your Life Easier, O'Reilly.
2. Ward, Grinstein Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick A K Peters, Ltd.

REFERENCE BOOK:

1. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

Course Objectives:

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

Courses Outcomes:

1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
2. Ability to program using HADOOP and Map reduce, NOSQL
3. Ability to understand the importance of Big Data in Social Media and Mining.

UNIT - I

Introduction to Big Data: Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

UNIT - II

Big Data Technologies: Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

UNIT - III

Introduction Hadoop: Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT - IV

Hadoop Architecture: Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

UNIT - V

Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

TEXT BOOKS:

1. Big Data Analytics, Seema Acharya, Subhasini 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.

REFERENCE BOOKS:

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 Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

DATA WRANGLING AND VISUALIZATION LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To learn data wrangling techniques
2. To introduce visual perception and core skills for visual analysis

Course Outcomes: Upon completion of the course, the students will be able to:

1. Perform data wrangling
2. Explain principles of visual perception
3. Apply core skills for visual analysis
4. Apply visualization techniques for various data analysis tasks
5. Evaluate visualization techniques

List of Experiments:

Implement the following experiments using Python

1. Find missing values and perform data imputation.
2. Find outliers in a chosen dataset.
3. methods to handle duplicate data.
4. Perform data normalization
5. Explore 2-D charts such as Clustered bar charts, connected dot plots, pictograms, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, univariate scatter plots, histograms word cloud, pie chart, waffle chart, stacked bar chart, tree map.
6. Multi-dimensional data visualization
7. Graph data visualization

TEXT BOOKS:

1. Jacqueline Kazil and Katharine Jarmul, Data Wrangling with Python: Tips and Tools to Make Your Life Easier, O'Reilly
2. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
3. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.

BIG DATA ANALYTICS LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

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

Course Outcomes:

1. Use Excel as a Analytical tool and visualization tool.
2. Ability to program using HADOOP and Map reduce
3. Ability to perform data analytics using ML in R.
4. Use cassandra to perform social media 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, Seema Acharya, Subhasini 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.

REFERENCE BOOKS:

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 Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

R18 B.TECH. MINOR IN INTERNET OF THINGS (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Python Programming (3 credits)	Python Programming Lab for 3 Hrs (1.5 credit)	4.5
2.	III - II Semester	Introduction to Internet of Things (3 credits) Smart Technologies (3 credits)	-----	6.0
3.	IV - I Semester	Programming Languages for IoT (3 credits)	IoT Automation with Raspberry PI Lab (1.5 credit)	4.5
4.	IV - II Semester	Fog & Edge Computing for IoT (3 credits)	----	3.0
			Total credits	**18.0**

PROGRAMMING LANGUAGES FOR IOT

L	T	P	C
3	0	0	3

Course Objectives:

1. This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi.
2. The course focuses on higher-level operating systems, advanced networking, user interfaces, multimedia and uses more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice

Course Outcomes:

1. Appreciate the development technology for IoT
2. Familiar with Basic Concepts of Linux
3. Design real time IoT Devices and Familiar with basic foundations of Python Programming and libraries
4. Comprehend the basic concepts of Mobile Cloud Computing

UNIT - I

Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution.

UNIT - II

Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operates the Raspberry Pi in “headless mode”, Bash Command line, operating Raspberry Pi without needing a GUI interface. Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.

UNIT - III

Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface

UNIT - IV

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs. Web Server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs

UNIT - V

IoT Design using Raspberry Pi IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, Communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi

TEXT BOOKS:

1. Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, January 2012, McGraw Hill Professional.
2. Raspberry Pi with Java: Programming the Internet of Things (IoT) (Oracle Press) 1st Edition.

3. The official raspberry Pi Projects Book, https://www.raspberrypi.org/magpiissues/Projects_Book_v1.pdf

REFERENCE BOOKS:

1. Eben Upton and Gareth Halfacree, “Raspberry Pi User Guide”, August 2016, 4th edition, John Wiley & Sons.
2. Alex Bradbury and Ben Everard, “Learning Python with Raspberry Pi”, Feb 2014, JohnWiley & Sons.
3. Michael Margolis, “Arduino Cookbook”, First Edition, March 2011, O'Reilly Media, Inc.

IOT AUTOMATION WITH RASPBERRY PI LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To introduce the raspberry PI platform, that is widely used in IoT applications
2. To introduce the implementation of distance sensor on IoT devices

Course Outcomes

1. Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
2. Get the skill to program using python scripting language which is used in many IoT devices

List of Experiments:

Using Raspberry Pi

1. Calculate the distance using a distance sensor
2. Basic LED functionality
3. Calculate temperature using a temperature sensor
4. Build an alarmed motion sensor
5. Make printer wireless
6. Add a power button to Raspberry pi
7. Build a network game server
8. Make music with sony Pi
9. Interface Pi Camera module with Raspberry Pi
10. Installing OS on Raspberry Pi
    a) Installation using Pilmager
    b) Installation using image File

R18 B.TECH. MINOR IN INNOVATION AND ENTREPRENEURSHIP (I&E) (2021-22)

S. No.	Year/Semester	Theory (3 Hours, 3 Credits)	Laboratory (3 Hours 1.5 Credits)	Total Credits
1.	III - I Semester	Innovation and Design Thinking	Design thinking and Ideation Laboratory	4.5
2.	III - II Semester	Foundations of Entrepreneurship (4 credits)	----	4.0
3.	IV - I Semester	Business Ideation and Lean Startup	B-Plan Development Laboratory	4.5
4.	IV - II Semester	**Any ONE of the following subjects:** 1. Product Development 2. Market Research 3. Engineering Design Process 4. Financial and Legal Aspects of Business 5. Start-up Management 6. Entrepreneurial Marketing 7. Technology Entrepreneurship 8. Small Business Development	----	3.0
5.	IV - II semester	Mini Project (Either on New Venture Establishment **OR** Launch of Marketable product **OR** Patent Publishing)		2.0
			Total Credits	**18.0**

Will be uploaded ASAP.