Detailed Syllabus

Subject Code	17M11CS112	Semester: ODD (specify Odd/Even)	Semester Ist Session 2019-2020 Month from July 19 to Dec 19
Subject Name	Machine Learning and Data Mining		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Chetna Dabas
	Teacher(s) (Alphabetically)	Dr. Chetna Dabas

COURSE OUTCOMES		COGNITIVE LEVELS
C112.1	Differentiate between Classification, Clustering and Association Rules techniques.	Apply [Level 3]
C112.2	Apply and Compare different classification techniques, e.g., k-Nearest Neighbours, Naïve Bayes, ID3 Decision Trees, Support Vector Machine, Ensemble methods .	Apply [Level 3]
C112.3	Apply and compare different clustering techniques, e.g., k-means, k-mediods, etc.	Apply [Level 3]
C112.4	Apply Apriori algorithm to generate the frequently used rules in a market basket analysis.	Apply [Level 3]
C112.5	Apply different dimensionality reduction techniques e.g. PCA, SVD, Factor Analysis, Linear Discriminant Analysis, etc., in big data scenarios.	Apply [Level 3]
C112.6	Apply Artificial Neural Network techniques, i.e., Back propagation, Feed forward Network, Kohonen Self-Organising Feature Maps, Learning Vector Quantization, etc, for solving classification and clustering problems.	Apply [Level 3]

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1	Introduction	Introduction to Machine Learning, Data Mining and Knowledge Discovery in Data Bases, Data Types	2
2	Classification	Introduction to classification, k-Nearest Neighbours, Naïve Bayes, Decision Trees	6
3	Regression	Linear Regression with One Variable, Linear Regression with Multiple Variables, Logistic Regression	4
4.	Clustering	Introduction, Different type of Clustering Methods, Partitioning Clustering Methods, Hierarchical Clustering Methods, k-means, k-medoids	6

5.	Association Rules	Frequent item sets, Apriori algorithm, Association rules	4
6.	Dimensionality Reduction	Introduction, Subset Selection, PCA, SVD, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis	8
7.	Artificial Neural Methods	Cost Function, Back propagation, Feed forward Network, Network training, Error Propagation, Application of Neural Networks	8
8.	Ensemble Methods	Ensemble methods of classification-Bagging, Boosting, and Random Forest	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Jiawei Han, Micheline Kamber, Data Mining, Morgan Kaufmann Publishers,Elsevier,2005
2.	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley
3.	Pujari, Arun K,Data mining and statistical analysis using SQL, Universities press
4.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining
5.	Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier
6.	Alex, Berson,Stephen J.Smith, Data Warehousing, data mining and OLAP , McGraw-Hill,2004
7.	Inmon W.H.,Building the Data Warehouse ,4th Edition, Wiley
8.	Anahory S. and Murray D, Data Warehousing in the Real World, Addison-Wesley
9.	Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall,2003
10.	Mattison R. ,Web Warehousing and Knowledge Management", Tata McGraw-Hill.
11.	David Hand, Heikki Mannila and Padhraic Smyth ,Principles of Data Mining,PHI
12.	Transactions on Database Systems (ACM)
13.	IEEE Transactions on Knowledge & Data Engineering
14.	The VLDB Journal The International Journal on Very Large Data Bases

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M11CS121	Semester ODD (specify Odd/Even)	Semester VII Session 2019 -2020 Month from July 2019- December 2019
Course Name	E-Commerce and Social Web		
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Sandeep Kumar Singh
	Teacher(s) (Alphabetically)	…

COURSE OUTCOMES		COGNITIVE LEVELS
C120.1	Compare and categorize different commercial models of E-commerce.	Understand Level (Level 2)
C120.2	Design and develop marketing strategies based on interactions and insights from Social web to enhance revenue promote brand and reach out to customers.	Create Level (Level 6)
C120.3	Make Use of Open source API s from various social networking sites.	Apply Level (Level 3)
C120.4	Outline suggestions and recommendations for Social Shopping.	Understand Level (Level 2)
C120.5	Measure the effect of different Social media marketing strategies using Social Media metrics.	Apply Level (Level 3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction and overview of e-Commerce	Definition and models of e-Commerce and examples. Selection of an E-commerce type and business model. Business models based on (1) Transaction Parties (2) Transaction Types. Case Studies of Indian context.	3
2.	Introduction to Social Web	Social Media : An Overview, Social Media Analytics: An Overview, SOCIAL MEDIA TEXT ANALYTICS, Twitter as Marketing Tool	5
3.	Social Web Landscape	Social Web overview, data-types, format, Text cleaning, tagging and storage, Social media techniques, tools and platforms, data visualization of data, research, applications and challenges in social Web.	3
4.	Introduction to Social e- Commerce	Introduction to Social Commerce, Supporting Theories and Concepts for Social Commerce, Tools and Platforms for Social Commerce	3
5.	Social Web Analysis	Analyzing Social web, Nodes, Edges and Network measures, Centrality, Power and Bottlenecks, Concept of Cliques, Clusters and Components, Viral marketing, Graph data in real world, Business use of Social web, Privacy in Social web, Influencer Outreach	5
6.	Social Shopping and Social Marketing	Social Media Marketing, Social Shopping: Concepts, Benefits, and Models, Customer Engagement and Metrics, Basic Social Marketing Strategies- Physical goods, Digital goods, Services, Affiliate Marketing, Guerrilla Marketing	5

7.	Programming using API and RSS feeds	Introduction to OAuth protocol, Programming and Crawling Social media using Twitter 4j Facebook API, LinkedIn API , Google +, Reddit, API, Instagram API	6
8	Twitter and Face book Data Analytics for Viral Marketing	Topic-based Clusters in Egocentric Networks on Facebook, Changes in Tie Strength Through Site Use on Facebook, Patterns of Responses to Resource Requests on Facebook, Exploring requests for help on Facebook, Analysis of User-Generated Content on Facebook, Predicting Clicks on Ads,Predicting the quality of new contributors to the Facebook crowdsourcing system	8
9.	Social Search Engine Optimization	Optimizing for Web Search, Using Photo-Sharing Sites for SEO, Optimizing for Social Search Engines	6
10.	Creating Suggestions and Recommendations	Perform web-market segmentation, making recommendations: collaborative filtering and content based filtering approaches, creating suggestions and building recommendation engines, Understanding recommendation engines based on users, items, and content, Finding recommendations about friends, articles, and news stories, Creating recommendations for sites similar to Netflix	6
	Total number of Lectures		**45**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments and Attendance)
Total	**100**

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Michael P Papazoglou and Pieter M.A. Ribbers, " e-Business- Organizational and technical foundation" , John Wiley and Sons, 2006.
2.	Efraim Turban , David King, Dennis Viehland, Jae Lee, "Electronic Commerce A Managerial Perspective 2006", 4ed, Pearson Education International edition, 2006.
3.	Stephen Chen, "Strategic management of e-business", second edition, John Wiley and Sons, 2005.
4.	RS Prasad, "Cyber crime: An Introduction", ICFAI Books, ICFAI University, 2004.
5.	RS Prasad, "Cyber crime: Combat Strategies", ICFAI Books, ICFAI University, 2004.
6.	RS Prasad, "CRM Present and Future", ICFAI Books, ICFAI University, 2005.
7.	Elaine Lawrence et al, "Internet commerce – Digital models for Business", John Wiley and Sons, 2003.
8.	Abhijit Choudhury and Jean-Pierre Kuilboer, "E-business and E-Commerece Infrastructure – Technologies supporting E-Business Initiative", McGraw Hill, 2002.
9.	Henry Chan et al, E-Commerece – fundamentals and applications", John Wiley and Sons, 2001.
10.	Programming Collective Intelligence: Building Smart Web 2.0 Applications by Toby Segaran
11.	Algorithms of the Intelligent Web Haralambos Marmanis, Dmitry Babenko
12.	Recommender Systems: An Introduction Dietmar Jannach (Author), Markus Zanker (Author), Alexander Felfernig (Author), Gerhard Friedrich
13.	Recommender Systems Handbook Francesco Ricci (Editor), Lior Rokach

14.	Recommendation Systems in Software Engineering Martin P. Robillard (Editor), Walid Maalej (Editor), Robert J Walker (Editor), Thomas Zimmermann
15.	Web Analytics 2.0 Avinash Kaushik
16.	Analyzing Social Web Jeneffir Golbeg
17.	Predictive Analytics Eric Segel

Lab-wise Breakup

Course Code	17M15CS112	Semester: ODD	Semester: I Session 2019 -2020
			Month from: July-Dec
Course Name	Machine Learning and Data Mining Lab		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	Coordinator(s)	Satish Chandra
	Teacher(s) (Alphabetically)	Satish Chandra

COURSE OUTCOMES		COGNITIVE LEVELS
C173.1	Identify the programming languages for machine learning techniques	Understanding (Level-2)
C173.2	Use Python to apply evaluate Linear regression, Logistic regression, kNN , k Means and ID3 on different datasets	Apply (Level-3)
C173.3	Deploy SVM and Neural Network by accessing and understanding the files that make up a trained model.	Apply (Level-3)
C173.4	Apply Deep Learning Neural networks to model object detection, video tagging, music genre detection etc.	Apply (Level-3)
C173.5	Evaluate different machine learning models on the basis of their performances	Evaluate (Level-5)

Module No.	Title of the Module	List of Experiments	CO
1.	Python for data sampling and Visualization	a. To write a program for writing the pixel values of an image b. Write programs for Data Sampling (given dataset).	1
2.	Python for text processing	Use IPython (a web version provided by Jupyter nootbook) to to write a word count program. Your program should read a text document (download from https://raw.githubusercontent.com/python/cpython/master/	1
3.	Classification-1	Implement kNN algorithm using Python. Consider iris dataset and report the accuracy of classification. [May take help from : https://machinelearningmastery.com/tutorial-to-	2

		implement-k-nearest-neighbors-in-python-from-scratch/]	
4.	Clustering	Clustering: Implement kMeans on Following dataset (download it from here).	2
5.	Classificat ion-2	Classify the wine dataset of UCI Repository by ID3.	2
6.	Data Mining-1	Implement Logistic Regression on a sample dataset (download it from here):	2
7.	SVM-1	Apply Support Vector Machine on the dataset of question the Parkinson dataset given in https://archive.ics.uci.edu/ml/datasets/Parkinson+Dataset+with+replicat ed+acoustic+features+.	3
8.	SVM-2	Apply Support Vector Machine on the dataset of question the Iris dataset given in https://archive.ics.uci.edu/ml/datasets/Iris	3
9.	Compariso n of Classificat ion algorithms	Compare the classification of Iris dataset by different algorithms namely kNN, ID3 and SVM. Report accuracy and other performance measures.Implement neural networks for Classification of *four* character patterns	5
10.	ANN	Apply Multi Layer Percepron for supervised learning (problem statement to be given individually)	3
11.	BPN	Use back propagation for supervised learning . For the data based on 1990 census data from California.Evaluate the accuracy of a model's predictions using RMSE.	3
12.	CNN	Implement CNN using TensorFlow for classifying MNIST images	4

Evaluation Criteria

Components	Maximum Marks
Lab Test1	20
Lab Test2	20
Mini Project, Regularity, performance	60
Total	100

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Jiawei Han, Micheline Kamber, Data Mining, Morgan Kaufmann Publishers,Elsevier,2005
2.	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley
3.	Pujari, Arun K,Data mining and statistical analysis using SQL, Universities press
4.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining
5.	Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier

6.	Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall,2003
7.	Mattison R. ,Web Warehousing and Knowledge Management", Tata McGraw-Hill.
8.	David Hand, Heikki Mannila and Padhraic Smyth ,Principles of Data Mining,PHI
9.	Transactions on Database Systems (ACM)
10.	IEEE Transactions on Knowledge & Data Engineering
11.	The VLDB Journal The International Journal on Very Large Data Bases

Course Code	17M21CS111	Semester Odd	Semester I Session 2018_2019
			Month from July 2018 to Dec 2018
Course Name	Cloud Based Big Data Systems I		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr Parmeet Kaur
	Teacher(s) (Alphabetically)	1. Dr Parmeet Kaur

COURSE OUTCOMES		COGNITIVE LEVELS
C111.1	Outline the concept and challenge of big data and how cloud technology is useful to store or analyze the big data	Outline Level 2
C111.2	Compare techniques of big data distribution in clouds – Partitioning and Replication.	Compare Level 4
C111.3	Outline Hadoop architecture and MapReduce framework.	Outline Level 2
C111.4	Explain Cloud NoSQL- Cassandra architecture, transaction processing and repair mechanisms for big data storage.	Explain Level 2
C111.5	Apply Cassandra CQL commands to define, query and manipulate a NoSQL database.	Apply Level 3
C111.6	Design and develop a simple application and connect with a NoSQL database, NewSQL database or Hadoop distributed file system. [Level 6]	Design Level 6

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Database Systems and Cloud Computing	Overview of Database Management Systems ,Basic principles of cloud computing, Classifying cloud services, and Basic terms and principles of DaaS (Database as a Service)	4
2.	Data Distribution: Partitioning and Replication	Data partitioning and replication techniques,Consistent Hashing, and Implementing highly available, scalable, and network partition tolerant cloud databases	6
3.	Trade-offs in Cloud Databases	Differences between conventional (relational) databases and cloud databases ACID database properties, CAP Conjecture, and BASE properties of cloud databases, NewSQL	4
4.	SQL based Cloud Databases	SQL compliancy, Transaction Control, Elasticity & Scalability. Case Study: NuoDB/ DB as a service	6
5.	Cloud NoSQL Databases	*Cloud Data Models*: Key-Value data model, Document data model, Column Family data model. Graph Data Model	2
6.	Cassandra Architecture and Cassandra Data	Internode Communication ,Data Distribution and Replication ,Partitioning , Snitches ,Basic features of Cassandra CDBMS, Formal definition of Cassandra column	6

		family data model, Cassandra CQL query language and CQL data model: Key space, Table definition, Column, and Data Types	
7.	Cassandra Consistency Levels	Configuring Data Consistency -Write Requests, Read Requests	3
8.	Cassandra Repair Mechanisms , Transaction Processing	Hinted Handoff Writes, Anti-entropy Node Repair, Transactions and Concurrency Control, Light Weight Transactions	5
9.	Cassandra CQL Queries	The Syntax of the SELECT Statement Simple SELECT expressions ,Filtering Data using WHERE Clause ,Using Indexes ,Filtering Collections , Querying Tables with Columns of the counter Type Keyspace Design Heuristics	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Assignments:10, Project: 10, Attendance:5)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Furht B., Villanustre F. (2016) Introduction to Big Data. In: Big Data Technologies and Applications. Springer, Cham
2.	Li, Kuan-Ching, Hai Jiang, Laurence T. Yang, and Alfredo Cuzzocrea, eds. *Big data: Algorithms, analytics, and applications*. CRC Press, 2015.
3.	Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. *Mastering cloud computing: foundations and applications programming*. Newnes, 2013.
4.	Zomaya, Albert Y., and Sherif Sakr, eds. *Handbook of big data technologies*. Berlin: Springer, 2017.
5.	Sullivan, Dan. *NoSQL for mere mortals*. Addison-Wesley Professional, 2015.
6.	Lam, Chuck. *Hadoop in action*. Manning Publications Co., 2010.

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	17M22CS113	Semester Odd (specify Odd/Even)	Semester I Session 2019 -2020 Month from July '19 to Dec '19		
Course Name	Soft Computing and Applications				
Credits	3		**Contact Hours**		3

Faculty (Names)	Coordinator(s)	Archana Purwar
	Teacher(s) (Alphabetically)	Kavita Pandey

COURSE OUTCOMES		COGNITIVE LEVELS
C130.1	Select defuzzification and other methods in fuzzy decision making	Apply Level (Level 3)
C130.2	Analyze different fuzzy inference systems for various real world problems.	Analyze Level (Level 4)
C130.3	Develop solutions for different problems using genetic algorithm and it's extensions	Apply Level (Level 3)
C130.14	Apply different neural network based algorithm	Apply Level (Level 3)
C130.5	Analyze the suitability of hybrid systems for a given problem	Analyze Level (Level 4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Soft Computing	Definition, Goals, Importance of Soft Computing and its applications	2
2.	Fuzzy Logic	Introduction to fuzzy logic, memberships functions, fuzzy relation, fuzzification and defuzzification, fuzzy inference System, fuzzy decision making: individual, multi objective, multi attribute and its applications to different branches of Science and Engineering.	12
3.	Genetic Algorithms in Problem Solving	introduction, Elements of Genetic Algorithms, Types of Genetic Algorithms, Multi objective Genetic algorithm , Problem solving using GA	10
4.	Artificial Neural Networks	Introduction to artificial intelligent network, network architectures , Back propagation networks, Learning Vector Quantization , Counter Propagation Networks, Auto encoders, RNN, LSTM and its applications	12
5.	Hybrid System	Integration of neural networks, fuzzy logic and genetic algorithms. Neuro-Fuzzy, Neuro-Genetic and Fuzzy-Genetic systems, Applications of Soft computing in different fields of research specially in Data Analysis and Communications.	6
Total number of Lectures			**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd, 2007.
2.	Melanie Mitchell, "An Introduction to Genetic Algorithm", MIT Press, Cambridge, England, 1996.
3.	Simon Haykin, "Neural Networks: A Comprehensive Foundation", Macmillan College Publishing Company, 1994.
4.	Mohamad H. Hassoun, "Foundamentals of Artificial Neural Networks", The MIT Press, 1995.
5.	S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Netwoks, Fuzzy Logic, and Genetic Algrithm", PHI Publication
6.	Kishan Mehrotra, Sanjay Ranka, Chilukuri K. Mohan , "Elements of Artificial Neural Networks"
7.	Mananda Rao, " Neural Network (Algorithm and Apllication)", Narosa Publication
8.	Timothy J. Ross, " Fuzzy logic with engineering Applications", Third Edition, Wiley
9.	George J. Klir/Bo Yuan, " Fuzzy Sets and Fuzzy logic", PHI
10.	Kalyanmoy Deb, " Multi-Objective Optimization Using Evolutionary Algorithms", Wiley
11.	IEEE Transactions on Knowledge and Data Engineering
12.	IEEE Transactions on Systems, Man and Cybernetics

Course Code	17M25CS111		Semester Odd (specify Odd/Even)		Semester M Tech (DA) 1st sem Session 2019 -2020 Month from July-Dec 2019
Course Name	Cloud Based Big Data Systems Lab-I				
Credits	1		**Contact Hours**		2

Faculty (Names)	Coordinator(s)	Dr Parmeet Kaur
	Teacher(s) (Alphabetically)	Dr Parmeet Kaur

COURSE OUTCOMES		COGNITIVE LEVELS
C174.1	Outline cloud based big data systems and classify them on basis of their features and applicability	Classify Level 2
C174.2	Apply Hadoop file system shell commands to perform various Hadoop distributed file system (HDFS) operations	Apply Level 3
C174.3	Develop a real-world application using the MapReduce framework	Develop Level 6
C174.4	Apply Cassandra CQL commands to define, query and analyze a NoSQL database.	Apply Level 3
C174.5	Apply NuoDB operations to insert and query data.	Apply Level 3

Module No.	Title of the Module	List of Experiments	CO
1.	Introduction To Cloud Based Big Data Systems	1. Investigate the Cloud Based Big Data Systems. 2. Use open source Big Data visualization Tool to form data analysis 3. Explore the various NoSQL systems	CO1
2.	Overview of Hadoop Framework	4. Apply Hadoop DFS commands for file manipulation.	CO2
3.	Map Reduce Framework	5. Write Map Reduce programs to solve big data problems	CO3
4.	Introduction to Cassandra	6. Install Cassandra 7. Perform Cassandra CRUD operations	CO4
5.	Aggregation with Cassandra	8. Perform data analysis with Cassandra aggregation operators	CO4
6.	Overview of NewSQL	9. Install NuoDB, understand its architecture 10. Define a big data store in NuoDB	CO5
7.	Working with NuoDB	11. Insert data in NuoDB 12. Query data from NuoDB	CO5

Evaluation Criteria

Components   **Maximum Marks**
1. Lab Test1   20
2. Lab Test 2   20
3. Lab Assignments   25

4.	Project	25
5.	Attendance	10
Total		**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Furht B., Villanustre F. (2016) Introduction to Big Data. In: Big Data Technologies and Applications. Springer, Cham
2.	Li, Kuan-Ching, Hai Jiang, Laurence T. Yang, and Alfredo Cuzzocrea, eds. *Big data: Algorithms, analytics, and applications*. CRC Press, 2015.
3.	Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. *Mastering cloud computing: foundations and applications programming*. Newnes, 2013.
4.	Sullivan, Dan. *NoSQL for mere mortals*. Addison-Wesley Professional, 2015.
5.	Lam, Chuck. *Hadoop in action*. Manning Publications Co., 2010.

Course Code	17M25CS113	Semester Even	Semester MTech-Ist year
			Session 2019 -2020
			Month from July 2019 to Dec 2019

Course Name	Data Science Programming Lab-I		
Credits	01	**Contact Hours**	0-0-2

Faculty (Names)	Coordinator(s)	Neetu Sardana
	Teacher(s) (Alphabetically)	Neetu Sardana

S.NO	COURSE OBJECTIVES	COGNITIVE LEVEL
C172.1	Understand the syntax and semantics of R programming language.	Understand level-2
C172.2	Importing different data formats and Apply data pre-processing techniques to handle missing values and noisy data values.	Apply Level-3
C172.3	Apply Data Visualization techniques for graphical representation and analysis of real world data.	Apply Level-3
C172.4	Apply varied Supervised and unsupervised techniques for classification for real world problems	Apply Level-3

Module No.	Title of the Module	List of Experiments	CO
1.	Basics of R	Objects,Functions, Number & Vector, Matrices & Array,Factors, Conditional Statements, Loop, Scripts, R package. List, List Operation, Recursive List, Data Frame, Creating Data Frame, Data Frame Operations, lapply() and sapply() functions.	CO1
2.	String Handling	Introduction to String handling, String functions, String Manipulation, Regular Expressions & Pattern Matching, and Introduction to "stringr" package.	CO1
3.	Import & Export	Introduction, Saving & Loading R data, Import and Export to different file formats: Excel File, Binary File, XML File, JSON File. Analyzing data & Reshaping the data.	CO2
4.	Data Preprocessing using R	Data Preprocessing, forms of Data Preprocessing, Data Cleaning Techniques, Data Redundancy- chi square test, correlation analysis, covariance coefficient, Data Transformation, Data Reduction- Principal Component Analysis, Regression, R packages for Data Preprocessing: caret, dplyr.	CO2
5.	Data Visualization	Visual Representation of statistical analysis, High level plotting commands- create plots with axes, titles, labels and others on the graphics device and Low level plotting commands- add new	CO3

6.	Classification and Clustering Algorithm	Classification Techniques: Introduction to Classification, Regression, Naïve Bayes, Decision Tree, KNN, Ensemble Methods. Clustering Techniques: Introduction to Clustering, K-means, Hierarchical Clustering, DB Scan.	CO4

Evaluation Criteria

Components	Maximum Marks
Lab Test 1	20
Lab Test 2	20
Quiz 1	10
Evaluation 1	15
Evaluation 2	15
Mini Project	20
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Paul Teetor.R Cookbook - Proven Recipes for Data Analysis, Statistics, and Graphics. O'Reilly, 2011.
2.	Alain F. Zuur, Elena N. Ieno, and Erik Meesters. A Beginner's Guide to R. Use R. Springer, 2009. ISBN: 978-0-387-93836-3.
3.	John Maindonald and John Braun. Data Analysis and Graphics Using R. Cambridge University Press, Cambridge, 2nd edition, 2007. ISBN 978-0-521-86116-8.
4.	Advanced R, by Hadley Wickham, ISBN 9781466586963.
5.	Using R for Introductory Statistics, by John Verzani, Chapman & Hall/CRC, 2004, ISBN 1584884509

Lecture-wise Breakup

Course Code	**18M11GE111**	Semester Odd	Semester I Month from	Session 2019 -2020 July to December
Course Name	Research Methodology & Intellectual Property Rights			
Credits	2		**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**	Prof. B. P. Chamola		
	Teacher(s) (Alphabetically)	Prof. B. P. Chamola		

COURSE OUTCOMES:		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C101.1	understand the basic concepts and types of research	Understanding Level (C2)
C101.2	define a research problem, its formulation, methodologies and analyze research related information	Analyzing Level (C4)
C101.3	follow research ethics, understand IPR, patents and their filing related to their innovative works.	Understanding Level (C2)
C101.4	understand and analyze the statistical data and apply the relevant test of hypothesis in their research problems	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Research	What is research? Types of research. What is not research? How to read a Journal paper?	3
2.	Report writing	How to write report? Use of Mendeley in report writing. How to write a research paper? Problem identification and solving.	4
3.	Ethics, IPR and Research methodologies	Research ethics, patents, intellectual property rights, plagiarism regulation 2018. Steps in research process and common methodologies to attempt solution to	8

		research paper.	
4.	Basics of statistics and probability distributions	Basic statistical concepts. Handling of raw data, Some common probability distributions.	7
5.	Test of hypothesis and regression analysis	Hypothesis testing. Parametric and non-parametric data, Introduction to regression analysis.	8

	Total number of Lectures	**30**
(Course delivery method: open ended discussion, guided self-study, lectures)		

Evaluation Criteria

Components	Maximum Marks
Mid Term Examination	30
End Semester Examination	40
Assignments	30 (Viva, Quiz, Assignments)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Stuart Melville and Wayne Goddard**, Research Methodology: An Introduction for Science & Engineering Students, Kenwyn, South Africa : Juta & Co. Ltd., 1996.
2.	**Kothari, C.R.,** Research Methodology: Methods and Techniques, New Age International, New Delhi, 2009.
3.	**Kumar, Ranjit,** Research Methodology: A Step by Step Guide for Beginners, 2nd Edition, Sage Publications Ltd., 2005.
4.	**Ramappa, T.,** Intellectual Property Rights Under WTO, S. Chand, New Delhi, 2008.
5.	**Wayne Goddard and Stuart Melville,** Research Methodology: An Introduction, Kenwyn, South Africa : Juta & Co, 2001.

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS
(18M11GE111)   L T P (2, 0, 0)

What is research? Types of research. What is not research?

How to read a journal paper? How to write report?

Use of Mendeley in report writing. How to write a research paper?

Problem identification and solving.

Research Ethics.

Steps in research process and common methodologies to attempt solution to research paper.

Basic statistical concepts. Handling of raw data.

Some common probability distributions.

Hypothesis testing. Parametric and non-parametric data.

Introduction to regression analysis.

Course Delivery Method: Open ended Discussion, Guided Self Study, Lectures.

Evaluation Strategy:
a) Mid Term written examination   -   30% weightage
b) End Term written examination   -   40% weightage
c) Assignment   -   30% weightage

BOOKS

1. **Stuart Melville and Wayne Goddard**, Research Methodology: An Introduction for Science & Engineering Students, Kenwyn, South Africa : Juta & Co. Ltd., 1996.

2. **Kothari, C.R.,** Research Methodology: Methods and Techniques, New Age International, New Delhi, 2009.

3. **Kumar, Ranjit,** Research Methodology: A Step by Step Guide for Beginners, 2nd Edition, Sage Publications Ltd., 2005.

4. **Ramappa, T.,** Intellectual Property Rights Under WTO, S. Chand, New Delhi, 2008.

5. **Wayne Goddard and Stuart Melville,** Research Methodology: An Introduction, Kenwyn, South Africa : Juta & Co, 2001.

Course Code	18M12CS117	Semester (Odd)	Semester I Session 2018 -2019
			Month from July - December

Course Name	Blockchain Technology and Applications		
Credits	03	**Contact Hours**	(L+T) (3+1)

Faculty (Names)	**Coordinator(s)**	Dr. P. Raghu Vamsi
	Teacher(s) (Alphabetically)	Dr. P. Raghu Vamsi

COURSE OUTCOMES		COGNITIVE LEVELS
C141.1	Understand the structure of a blockchain and why/when it is better than a simple distributed database	Understand Level (Level 2)
C141.2	Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities	Evaluate Level (Level 5)
C141.3	Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations	Apply Level (Level 3)
C141.4	Attain awareness of the new challenges that exist in monetizing businesses around blockchains and smart contracts	Analyze Level (Level 4)
C141.5	Describe and apply the differences between the most prominent blockchain structures and permissioned blockchain service providers, as well as rising alliances and networks	Apply Level (Level 3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Blockchain Basics	What is Blockchain (BC), public ledgers, BC as public ledgers; BC history - Bitcoin and Cryptocurrency, BC 2.0, Smart contracts; BC architecture – Blocks in BC, transactions and distributed consensus; BC conceptualization - The Chain and the Longest Chain, Cryptocurrency to Blockchain 2.0, Permissioned Model of Blockchain.	4
2.	Cryptographic Primitives	Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency	5
3.	Distributed Consensus	Distributed consensus in open environments, Consensus in a Bitcoin network; Bitcoin Consensus - Proof of Work (PoW) – basic introduction, Hashcash PoW, Beyond Consensus in Bitcoin - Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time; Consensus in Bitcoin (The Miners) - The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.	6
4.	Smart contracts – 1	Smart contracts, Solidity, REMIX IDE, Ethereum Blockchain, Ethereum Virtual Machine.	8
5.	Smart contracts – 2	Decentralized applications (Dapps), Truffle development, Design improvements, Application models and standards	7

6.	Use cases	Blockchain for Voting, Government Use-cases – Public distribution system, Blockchain for Tax Payments, Blockchain for Managing Land Registry Records	3
7.	Other Blockchain frameworks	IBM Hyperledge fabric	7-10
9.	Research aspects in Blockchain	Consensus protocols, Identity management, Strong and weak synchronization, avoiding forks, Mining improvements.	3
		Total number of Lectures	42-45

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Drescher, Daniel. "Blockchain basics", Apress, 2017.
2.	Mougayar, William. "The business blockchain: promise, practice, and application of the next Internet technology", John Wiley & Sons, 2016.
3.	Dannen, Chris. "Introducing Ethereum and Solidity", Berkeley: Apress, 2017.
4.	Prusty, Narayan. "Building Blockchain Projects", Packt Publishing Ltd, 2017.
5.	Pilkington, Marc. "Blockchain technology: principles and applications" Research handbook on digital transformations, 2016.
6.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
7.	Swan, Melanie, "Blockchain: Blueprint for a new economy", O'Reilly Media, Inc., 2015.
8.	Antonopoulos, Andreas M. "Mastering Bitcoin: unlocking digital cryptocurrencies", O'Reilly Media, Inc., 2014.