Detailed Syllabus
Lecture-wise Breakup

Course Code	14M1NCI339	**Semester Odd (specify Odd/Even)**	**Semester** M.Tech (III) **Session** 2018-19 **Month from** Jul-Dec
Course Name	Wireless Sensor and Actuator Networks		
Credits	3	**Contact Hours**	3-0-0 (3 hrs per week)

Faculty (Names)	**Coordinator(s)**	Dr. Adwitiya Sinha
	Teacher(s) (Alphabetically)	Dr. Adwitiya Sinha

COURSE OUTCOMES		**COGNITIVE LEVELS**
C140.1	Develop distribution models for deterministic or stochastic network deployment	Understand Level (Level 2)
C140.2	Designing communication protocols for wireless sensor network standards	Apply Level (Level 3)
C140.3	Develop mathematical models for energy consumption	Creation Level (Level 6)
C140.4	Analyse medium access mechanisms, routing protocols	Analyze Level (Level 4)
C140.5	Analyse cross layer schemes, including load balancing and node clustering	Analyze Level (Level 4)
C140.6	Performance evaluation of sleep scheduling strategy with data prediction and aggregation methods	Evaluation Level (Level 5)
C140.7	Develop Coverage Maximization models for optimizing network lifetime	Creation Level (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Wireless sensor and actuator networks	Introduction to wireless networks and mainly on sensor and actuator networks, Terminology, Introductin radio spectrum, Applications, Propagation mechanism-Free space and Two Ray model, Functions: aggregation, dissemination and management	5
2.	Wireless Sensor Network Requirements	Network scenarios, Types of deployment strategies, Challenges, Sensor components and characteristics, Energy Harvesting, Distributed sensor network	5
3.	Technologies and simulators used	Network Simulator, Glomosim, Qualnet	4
4.	Sensor Network Architectures & Standards	IEEE Sensor Network Standard/ZigBee, Single-hop and Multi-hop communication, Sink mobility, Transmission Power Control (levels of transmission), In-Network Data Processing	5
5.	Broad casting & Routing in Wireless Sensor and Actuator Networks	Overview of broadcasting techniques, backbone and broadcasting in sensor actuator networks, coverage and connectivity criteria,Routing alogs	7
6.	Issues and	Sleep scheduling Models & Analysis, Clustering, Load	6

	Challenges	balancing, Energy Hole and Connectivity Gap problem, Poissonian and Gaussian distributed network	
7.	Designing Goals and Protocols	Energy Models, Network Lifetime Maximization, Scheduling & Coverage Optimization. MAC protocols-Low duty cycle and Wake up concepts, Cross layer issues & methods – Optimizing number of Clusters & Cluster Head rotations, Data and Flow Aggregation with analysis	6
8.	Case Studies	Case study of Internet of things applications & open source projects	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
Test-1	20
Test-1	20
End Semester Examination	35
TA	25 (Quiz + Evaluative Assignment + Class Test + 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.	Wireless Sensor and Actuator Networks Algorithms and Protocols for Scalable Coordination and Data Communication, Edited by Amiya Nayak and Ivan Stojmenovic John Wiley & Sons, Inc.,2010.
2.	Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: An Information Processing Approach, Morgan Kauffman Publication, 2004
3.	William Stallings, Wireless Communications & Networks, 2nd Edition, Pearson Education India, 2009
4.	Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley-Blackwell; 1st edition, 2007
5.	Andrea Conti, Davide Dardari, and Roberto Verdone, Wireless Sensor and Actuator Networks Technologies, Analysis and Design, Academic Press, Elsevier, 2008

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17M1NCI131**	**Semester Odd (specify Odd/Even)**	**Semester – 2nd Month from Jul to Dec**
Subject Name	Flexible Computer Networks		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	1. Sangeeta Mittal
	Teacher(s) (Alphabetically)	1. Sangeeta Mittal

Course Outcomes

CO#	Course Outcome	Cognitive Level (Bloom's Taxonomy)
1.	Explain the current network-traffic characteristics and modern networking scenarios	Understanding (level - 2)
2.	Assess limitations of classical networking techniques in supporting recent applications	Analyzing (level-4)
3.	Explain Software Defined Network architecture, need and concepts	Understanding (level - 2)
4.	Experiment with Openflow based southbound API in Mininet emulator	Applying(level-3)
5.	Evaluate SDN using Pox and OpenDaylight SDN Controllers	Evaluating(level-5)
6.	Build traffic engineering modules for load balancing, quality of service and multicast data transport in SDN	Creating(level-6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Modern Networking Elements	Fast Ethernet , Gigabit WiFi, 4G/5G Cellular , Cloud Computing , IoT	3
2.	Basics of Modern Network Traffic	Types of Network Traffic, Real time characteristics, Big Data, Cloud Computing and Mobile Traffic , QoS and QoE – Difficulties in achieving them	4
3.	Drivers and Components of Flexible Networking	Evolving Requirements SDN and NFV	2
4.	Introduction to Software Defined Network (SDN)	Architecture , Characteristics, Standards, Open Development Initiatives	3
5.	SDN Data Plane and Open Flow	Data Plane Functions, OpenFlow logical network Device – Flow Tables, Group Tables, Openflow Protocol	6
6.	SDN Control Plane	Control Plane Architecture , OpenDaylight Project – Architecture and APIs	6
7.	SDN Application Plane	Application Plane Architecture, Data center networking and Information center networking over SDN	6
8.	Network Function	Virtualization Approach, NFV use	4

	Virtualization (NFV) – Concepts	cases, NFV and SDN	
9.	NFV Infrastructure	Virtualized Network Functions, Virtual LAN, Virtual Tenant Network	6
		Total number of Lectures	**40**

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17M11CS111	**Semester (specify Odd/Even)**	**Semester Odd Session 2019-2020 Month from July 19 to December 20**
Subject Name	Data structure & Algorithms for Big Data		
Credits	**3**	**Contact Hours**	**3(L)**

Faculty (Names)	**Coordinator(s)**	Dr. Amarjeet Prajapati
	Teacher(s) (Alphabetically)	Dr. Amarjeet Prajapati

S.N.	DESCRIPTION	COGNITIVE LEVEL (BLOOM TAXONOMY)
C110.1	Define basic concepts of Big Data and relating them to them with various Big Data technologies (e.g., Hadoop, Spark)	Remember Level (Level 1)
C110.2	Explain Hadoop cluster architecture and its components and Differentiate Hadoop Distributed File System (HDFS) from other storage techniques, e.g., NFS and UNIX file system	Understand Level (Level 2)
C110.3	Construct data structure and algorithms for HDFS and MapReduce and further applying them to different Big Data problems.	Apply Level (Level 6)
C110.4	Apply hashing on large scale multi-dimensional data sets using Locality Sensitive Hashing.	Apply Level (Level 3)
C110.5	Analyze and apply advance data structures and algorithms (e.g., B and B+ Tree, R and R+ Tree, Matrix multiplication) for solving big data problems	Analyze Level (Level 4)
C110.6	Evaluate Streaming Algorithms, Sublinear optimization, Machine Learning, Hadoop systems	Evaluate Level (Level 5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Big Data	Motivation, Application, Domains for Big Data, Various tools and services	2
2.	Basic Statistics	Various types of parametric and non-parametric test	2
3.	File system	Introduction to HDFS, Read and write operation, Types of failures	3
4.	MapReduce	Introduction to MapReduce, Mapreduce Job scheduling	3
5.	Basic data structures concepts	Array: searching, sorting, aggregation on BIG DATA	4
6.	Matrix Multiplication	Matrix Multiplication for BIG DATA	2

7.	File systems	Various file systems like HDFS and Toku FS etc. Variable-sized rows, Concurrency-control mechanisms, Multithreading, Transactions, logging, ACID compliant, crash recovery	5
7.	Graphs	Spanning Tree (Min/Max), Searching (BFS), Shortest Path etc.	6
8.	Indexing strategies Trees	large Arrays, Hashing, AVL, B-tree, Tries, R and R+ Trees, Prefix Trees, Accumulo, Bigtable, bLSM, Cassandra, HBase,Hypertable, LevelDB are LSM trees, divide & conquer, mapreduce	6
9.	Bloom filters, HyperLogLog, Count–2 min sketch	Bloom filters, HyperLogLog, Count–2 min sketch	4
10	Applications (may use spark)	Streaming Algorithms, Sublinear optimization, Machine Learning Problems, Hadoop systems	2
11	Mathematical Foundation	Sparse: Vector Spaces, Matrix algebra, LSI,SVD, PSD	3
Total number of Lectures			**42**

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.	Journals: IEEE Transactions on Knowledge and Data Engineering, ACM Transactions on Intelligent Systems and Technology (TIST), ACM Transactions on Knowledge Discovery from Data (TKDD)
2.	2. Tier-1 Conferences: SIGKDD, ICDE - International Conference on Data Engineering, CIKM - International Conference on Information and Knowledge Management, ICDM - IEEE International Conference on Data Mining, SDM - SIAM International Conference on Data Mining, PKDD - Principles of Data Mining and Knowledge Discovery, IEEE Big Data
3.	3. Online courses: http://grigory.us/big-data-class.html https://courses.engr.illinois.edu/cs598csc/fa2014/
4.	4. Book: Mahmoud Parsian, "Data Algorithms: Recipes for Scaling Up with Hadoop and Spark", O'Reilly Media, July 2015.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17M11CS112	**Semester Odd (specify Odd/Even)**	**Semester** Even **Session** 2018 - 19 **Month from** July to December
Subject Name	Machine Learning and Data Mining		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Bharat Gupta
	Teacher(s)	Bharat Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C112.1	Differentiate between Classification, Clustering and Association Rules techniques.	C2
C112.2	Apply and Compare different classification techniques, e.g., k-Nearest Neighbours, Naïve Bayes, ID3 Decision Trees, Support Vector Machine, Ensemble methods , etc.	C3
C112.3	Apply and compare different clustering techniques, e.g., k-means, k-mediods, etc.	C3
C112.4	Apply Apriori algorithm to generate the frequently used rules in a market basket analysis.	C3
C112.5	Apply different dimensionality reduction techniques e.g. PCA, SVD, Factor Analysis, Linear Discriminant Analysis, etc., in big data scenarios.	C3
C112.6	Use 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.	C3

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 itemsets, 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 (Attendance (10), Quiz performance (15))**
Total	**100**

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

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

Syllabus Description

Course Code	17M12CS115 (C142)	**Semester** Odd	**Semester** 3rd **Session** 2019 - 2020 **Month from** July **to** December
Subject Name	3D Graphics and Animation		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator**	Dr. Suma Dawn
	Teacher(s)	Dr. Suma Dawn

COURSE OUTCOMES		**COGNITIVE LEVELS**
C142.1	Explain the theories of 3D objects and various media environments.	Understanding Level (Level 2)
C142.2	Propose solutions to given case studies by illustrating various methods and environments related to 3D graphics such as geometry, transformations and modeling, visibility detection, lighting, illumination, etc.	Creating Level (Level 6)
C142.3	Create multimedia-rich content, specifically comic frames and animations.	Creating Level (Level 6)
C142.4	Design dynamic and interactive animations using scripting to implement fun games and create richer content.	Creating Level (Level 6)
C142.5	Critique and compare various advanced animation principles such as rigid body dynamics, natural phenomena and modelling, 3D object manipulation, etc.	Evaluating Level (level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Fundamentals of 2D and 3D graphics and Animation Designing	1
2.	3D Graphics	3D Primitives, Geometry, transformations and Modeling; Visibility Detection; Lighting, Illumination, and Shading, Texture Mapping; Sub-division Surfaces, Implicit surfaces and voxels, creating complex geometry; Imaging and Rendering. Related Programming, 2D and 3D object creation	22
3.	Animation	Fundamentals; Motion Creation, Animating articulated structures, kinematics and inverse kinematics; Creation of simple animation with and without actionscripting.	17
4.	Introduction to Advanced Animation and Principles.	Physically based modeling and simulation, rigid body dynamics; Natural Phenomena and Modeling (plants, arms, etc), and other Simulation; 3D object manipulation, Visualization and other advanced algorithms and topics.	2
		Total number of Lectures	**42**

Evaluation Criteria	A. THEORY Examination	Marks
	I. Test1	20
	II. Test2	20
	III. End Term	35
	B. Internal - including Assignments, Quizzes, attendance	25
	Total	100

Recommended Reading material: (APA format)	
1.	Parent, R. (2012). *Computer animation: algorithms and techniques*. Newnes.
2.	Walnum, C. (1995). *3-D Graphics Programming with OpenGL*(Vol. 1, p. 996). Que Corporation.
3.	Buss, S. R. (2003). *3D computer graphics: a mathematical introduction with OpenGL*. Cambridge University Press.
4.	Giambruno, M. (2002). *3D graphics and animation*. New Riders Publishing.
5.	Rogers, D. F. (2000). *An introduction to NURBS: with historical perspective*. Elsevier.
6.	Newman, W. M., & Sproull, R. F. (1979). *Principles of interactive computer graphics*. McGraw-Hill, Inc..
7.	Watt, A., & Policarpo, F. (2005). *Advanced game development with programmable graphics hardware*. AK Peters/CRC Press.
8.	Ferguson, R. S. (2013). *Practical algorithms for 3D computer graphics*. AK Peters/CRC Press.
9.	Pakhira, M. K. (2010). *Computer Graphics, Multimedia and Animation*. PHI Learning Pvt. Ltd..
10.	Perkins, T. (2007). *Adobe Flash CS3 Professional Hands-On Training*. Peachpit Press.
11.	Springer's Multimedia Tools and Applications
12.	IEEE Transactions on Multimedia
13.	ACM Transactions on Multimedia Computing, Communications and Applications
14.	Interactive Multimedia Electronic Journal of Computer-Enhanced Learning.

Detailed Syllabus
Lab-wise Breakup

Course Code	**17M15CS111**	**Semester:** ODD	**Session** 2018 -2019 **Month from** July to Dec, 2018
Course Name	**Advanced Algorithms Lab**		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Deepti Singh
	Teacher(s) (Alphabetically)	Dr. Nisha Chaurasia

COURSE OUTCOMES		**COGNITIVE LEVELS**
C170.1	Implement algorithms and use appropriate advanced data structures for solving computing problems.	Level 3: Apply
C170.2	Design algorithms using the divide-and-conquer, greedy and dynamic programming strategies, and further recite algorithms that employ these strategies.	Level 1: Remember Level 5: Evaluate
C170.3	Illustrate the mathematical foundation of network flows and some important flow algorithms.	Level 2: Understand Level 3: Apply
C170.4	Implement randomized algorithms to solve various problems, and validate their correctness and complexity.	Level 3: Apply Level 4: Analyze
C170.5	Understand P, NP, polynomial reduction, NP-hardness, and NP-Completeness.	Level 2: Understand Level 4: Analyze
C170.6	Comprehend and select algorithm design approaches in a problem specific manner.	Level 6: Create

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Fundamentalsof data structures and algorithmic problem solving	Searching, Sorting, time complexity, Heaps, Arrays, Linked List, Trees, Fibonacci heaps, splay trees, dynamic trees.	CO1
2.	Divide and Conquer Technique	Solving Matrix multiplication problem and subset- sum problem using divide-and-conquer approach	CO2
3.	Greedy Algorithms	Greedy Approximation algorithms- Set Cover Problem,K Centers Problem,Fractional and 0/1 Knapsack, Coinage problem; Bin packing; Job scheduling, Graph coloring; and Text compression using Huffman coding and Shannon-Fano coding.	CO2
4.	Dynamic Programming Technique	Fundamentals of Dynamic programming based solution approach, Printing Shortest Common Supersequence, Dynamic Programming on Trees, Maximum sum rectangle in a 2D matrix.	CO2
5.	Graph Algorithms	Solve and analyze Graph problems, Algorithms. All Pair Shortest Problem Subset-sum problem. Minimum Spanning Trees (Prim's and Kruskal algorithms); Shortest Path using Dijkstra's algorithm, K-clique problem, Graph Coloring problem.	CO1, CO2

6.	Flows in Network	Network flows - max flow and min-cost flow/circulation, Edmonds-Karp algorithm	CO3
7.	Tractable and Non- Tractable Problems	One Way of Coping with NP-Hardness. Randomized Rounding. Vertex Cover and Travelling Salesman Problem.	CO4, CO5
8.	Project	Project	CO6

Evaluation Criteria

Components	**Maximum Marks**
Lab Test# 120	
Lab Test# 2	20
D2D work 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.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein , Introduction to Algorithms, MIT Press, 3rd Edition, 2009
2.	Hochbaum "Approximation Algorithms for NP-Hard Problems", 1996.
3.	Ahuja, Magnanti and Orlin, "Network Flows: Theory, Algorithms and Applications", 1993.
4.	Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 1978
5.	Study material on //fileserver2

Detailed Syllabus

Lab-wise Breakup

Course Code	17M15CS112	**Semester: ODD**	**Semester: I Session** 2018 -2019 Month from: July-Dec
Course Name	Machine Learning and Data Mining Lab		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Bharat Gupta
	Teacher(s) (Alphabetically)	Bharat Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C173.1	Understanding basic syntax in Python	Understanding Level (C2)
C173.2	Understanding Control Flow and looping in Python	Understanding Level (C2)
C173.3	Apply and Compare different classification techniques, Logistic Regression e.g., k-Nearest Neighbours, Support Vector Machine, etc.	Apply Level (C3)
C173.4	Apply clustering techniques k-Means on a dataset	Apply Level (C3)
C173.5	Apply dimensionality reduction technique e.g. PCA on a dataset.	Apply Level (C3)
C173.6	Analyse the real world problem to identify the appropriate data science techniques for classification, clustering and Association rules	Analyse Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Python basic syntax	Practicing basic python commands	CO1
2.	Control Flow and looping in Python	1. Write a python program that displays the sum of all digits for a user entered number. 2. Write a python function leap_year that prints all the leap years between ranges. The user will enter lower and upper year boundary inside the function. 3. Write a program that outputs all possible strings formed by using the characters a, c, t, o, and g. a particular character can appear only once and all the characters should be used in the formation of string. 4. Write a python script that takes input from file representing a paragraph, and writes to a file named	CO1

		out.txt with all the stop words (a, an, the) removed. 5. Write a recursive function in python to print a Fibonacci series. The Fibonacci sequence is the series of numbers: 0,1,1,2,3,5,8,13,21,34,…etc 6. Write a program for sorting the integer data by using quick sort.	
3.	K-NN	Implement the KNN (K Nearest Neighbours) algorithm in python. Your program should have different functions as follows: 1. HandleData: Open the dataset from CSV and split into test/train (datasets). A ratio of 67/33 for train/test is a standard ratio used for splitting data. 2. Similarity: Calculate the distance between two data instances. The Euclidean distance is used for calculating the difference. It is defined as the square root of the sum of the squared differences between the two arrays of numbers. Only first 4 attributes are used for calculating the distance. 3. Neighbours: Locate k most similar data instances. 4. Response: Generate a response from a set of data instances. It is a function for getting the majority voted response from a number of neighbors. It devises a predicted response based on those neighbors. 5. Accuracy: Summarize the accuracy of predictions. An easy way to evaluate the accuracy of the model is to calculate a ratio of the total correct predictions out of all predictions made, called the classification accuracy. 6. Main: Take split = 0.67, k=3.	CO3
4.	Weka Toolkit	1. Apply the KNN algorithm in Weka tool on the iris dataset. Compare the results of your implemented algorithm with algorithm of Weka tool. 2. Implement the linear Regression. The data will be taken as input from the file. Select the appropriate dataset from the website https://archive.ics.uci.edu/ml/index.php". Justify the reason why the dataset has been selected. b) Apply the Linear regression in Weka tool on the same dataset. Compare the results of your implemented algorithm with algorithm of Weka tool.	CO3
5.	Clustering	Remove the label column of the Parkinson_dataset.csv dataset and implement the following: a) Perform K-Means clustering and Hierarchical clustering. b) Use Manhattan distance c) Use Average merging Strategy in Hierarchical	CO4

		clustering. d) Use three different K values in K-Mean clustering. e) Validate using RMSE and compare both the techniques.	
6	Logistic regression and SVM	Divide the Parkinson_dataset.csv dataset in training and testing dataset randomly and implement the following: a. Classify the disease using Logistic regression and SVM b. Find out the accuracy of classification Model. c. Perform 5-fold cross- validation. d. Compare the result of both techniques using matplotlib.	CO3
7	scikit-learn toolkit	Implementation of the following algorithms in scikit-learn a. Principal components analysis (PCA) b. Decomposing signals in components (matrix factorization problems) c. K-means	CO5
8	Mini Project	1. Specify the broad topic of your mini project based on the Machine Learning and Data mining. 2. Study minimum 6 quality research papers based on the selected topic. 3. Do the SWOT analysis of selected research papers/reports. 4. Identify the research problem. 5. Propose your novelty/improvement in terms of algorithm/new feature. 6. Design the architecture for the proposed problem. 7. Design the test bed. 8. Design a set of experiments to be carried out for the proposed problem. 9. Perform the experimental analysis (in Python language only). 10. Prepare your report. 11. Write a short research paper based on your contribution.	CO6

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

Detailed Syllabus

Lab-wise Breakup

Course Code	17M15CS113	**Semester** … **Odd**	**Semester** … **Session** 2018 -2019 Month from July to Dec, 2018
Course Name	**Cloud Technology Lab**		
Credits	1	**Contact Hours**	2 Hours

Faculty (Names)	**Coordinator(s)**	Dr Prakash Kumar
	Teacher(s) (Alphabetically)	Dr. Prakash Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C171.1	Demonstrate the architecture and layers of Cloud Service Models, Deployment models etc.	Understand (level 2)
C171.2	Understand the working of CloudSim and run different scheduling alogorithms.	Apply (level 3)
C171.3	Analyze various Scheduling algorithms and compare their performances	Analyze (level 4)
C171.4	Apply and evaluate the energy aware algorithms for using DVFS techniques.	Evaluate (level 5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	CloudSim installations and Use	Create Virtual Machines (VMs) on CloudSim.	CO1
2.		Allocate different Cloudlets to VMs and Data Centers using different scheduling algorithms	CO2
3.	Analyze various Scheduling algorithms in different scenarios on cloudsim	Create different Data Centers and allocate the VMs to them and analyze the outcomes	CO3
4.		Assign the cloudlets and change the scheduling techniques for various scenarios	CO3
5.	Evaluate Energy Aware Simulations using DVFS	Apply and evaluate energy aware algorithms using DVFS techniques	CO4
***n*.**	…	…	…

Evaluation Criteria

Components	**Maximum Marks**
Lab Test# 1	20
Lab Test# 2	20

D2D work	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.	K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier.
2	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.
3	"Virtualization Overview", White paper, VM Ware.
4.	Rodrigo N. Calheiros, Rajiv Ranjan, Anton Beloglazov, Cesar A. F. De Rose, and Rajkumar Buyya, CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments and Evaluation of Resource Provisioning Algorithms, Software: Practice and Experience, Volume 41, Number 1, Pages: 23-50, ISSN: 0038-0644, Wiley Press, New York, USA, January 2011.
5.	Tom Guérout, Thierry Monteil, Georges Da Costa, Rodrigo Neves Calheiros, Rajkumar Buyya, Mihai Alexandru, Energy-aware Simulation with DVFS, Simulation Modelling Practice and Theory, Volume 39, No. 1, Pages: 76-91, ISSN: 1569-190X, Elsevier Science, Amsterdam, The Netherlands, November 2013.
6.	Rajkumar Buyya, Rajiv Ranjan and Rodrigo N. Calheiros, Modeling and Simulation of Scalable Cloud Computing Environments and the CloudSim Toolkit: Challenges and Opportunities, Proceedings of the 7th High Performance Computing and Simulation Conference (HPCS 2009, ISBN: 978-1-4244-4907-1, IEEE Press, New York, USA), Leipzig, Germany, June 21 - 24, 2009. **- Keynote Paper.**
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Detailed Syllabus

Lecture-wise Breakup

Course Code	18M11GE111	**Semester** Odd	**Semester** I	**Session** 2018 -2019	
			Month from	July 2018 to Dec 2018	
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:		
CO1	understand the basic concepts and types of research	Understanding Level (C2)
CO2	define a research problem, its formulation, methodologies and analyze research related information	Analyzing Level (C4)
CO3	follow research ethics, understand IPR, patents and their filing related to their innovative works.	Understanding Level (C2)
CO4	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 research paper.	8

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

Evaluation Criteria

Components	**Maximum Marks**
Viva –1 before T2 1 Exam	15
Viva –2 after End Sem.	20
End Semester Examination	35
Assignments	30 (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.

Detailed Syllabus
Lecture-wise Breakup

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.