Detailed Syllabus
Lecture-wise Breakup

Course Code	19M12CS112	**Semester** Odd **(specify Odd/Even)**	**Semester** I **Session** 2019 -2020 **Month** from July to Dec
Course Name	Metaheuristics in Modelling and Optimization		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Anita Sahoo
	Teacher(s) (Alphabetically)	Dr. Anita Sahoo

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C131.1	Interpret and explain the concepts of Metaheuristics based optimization and it's application in a diverse range of applications.	Understand Level (C2)
C131.2	Model single solution and population based Metaheuristic algorithms to solve a given optimization problem.	Apply Level (C3)
C131.3	Model Metaheuristic algorithms to solve Multi-objective optimization problems.	Apply Level (C3)
C131.4	Model hybrid Metaheuristic algorithms to solve a given optimization problem.	Apply Level (C3)
C131.5	Explain algorithms and architectures for parallel implementation of Metaheuristics.	Understand Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Optimization Models, Approximate Algorithms, When to use Metaheuristics?, Methods and Application	4
2.	Fundamentals of Metaheuristics	Representation, Objective Functions; Constraint Handling; Parameter Tuning; Performance Analysis.	5
3.	Single-Solution Based Metaheuristics	Basic Concepts, Fitness Landscape Analysis; Local Search; Tabu Search; Iterated and Guided Local search; Variable Neighborhood Search; Smoothing Methods; Noisy Methods	6
4.	Population-Based Metaheuristics Methiods	Basic Concepts; Evolutionary Algorithms, Swarm Intelligence, Stochastic diffusion search, Social cognitive optimization	6
5.	Metaheuristics for Multiobjective Optimization	Basic concepts; Multiobjective Continuous and Combinatorial Problems, Multicriteria Decision Making; Design Issues	3
6.	Fitness Assignment Strategies and Evaluation of Multiobjective Optimization	Scalar approach, Criterion-Based Methods; Dominance-Based Approaches; Indicator based Approaches; Diversity Preservation; Performance Evaluation	7
7.	Hybrid Metaheuristics	Design and Implementation Issues; Mathematical Programming Approaches; Classical Hybrid Approaches; Hybrid Metaheuristics with Machine Learning and Data Mining; Hybrid Metaheuristics for Multiobjective Optimization	7
8.	Parallel Metaheuristics	Parallel Design and Implementation of Metaheuristics; Parallel Metaheuristics for Multiobjective Optimization	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.	Metaheuristics: From Design to Implementation by El-Ghazali Talbi, Wiley, June 2009.
2.	Sean Luke, 2013, Essentials of Metaheuristics, Lulu, second edition, available athttp://cs.gmu.edu/←sean/book/metaheuristics.
3.	Gandomi, Amir; Yang, Xin-She; Talatahari, Siamak; Alavi, Amir; "Metaheuristic Algorithms in Modeling and Optimization", Metaheuristic Applications in Structures and Infrastructures, Dec 2013.
4.	Kalyanmoy Deb; "Multi-Objective Optimization Using Evolutionary Algorithms:An Introduction"; https://www.egr.msu.edu/~kdeb/papers/k2011003.pdf
5.	Kalyanmoy Deb; "Single and Multi-Objective Optimization Using Evolutionary Algorithms"; https://www.iitk.ac.in/kangal/papers/2004002.pdf
6.	Paulo Cortez, Modern Optimization with R, Use R! series, Springer, September 2014, ISBN 978-3-319-08262-2.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M11CS111	**Semester (specify Odd/Even)**	**Semester Odd Session 2019-2020 Month from July 19 to December20**
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

COURSE OUTCOMES		**COGNITIVE LEVELS**
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)

S.N.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**	**Remarks**
1.	Introduction to Big Data	Motivation, Application, Domains for Big Data,Various tools and services	2	
2.	Basics of Hadoop	Introduction to hadoop. Introduction to HDFS, Read and write operation, Fault Tolerance-Failures and Recovery,:	3	
3.	MapReduce	Introduction to MapReduce, Mapreduce Job scheduling	3	
4.	Basic data structures concepts	Array: searching, sorting, aggregation on BIG DATA	4	
5.	Basic Statistics	Various types of parametric and non-parametric test	2	
6.	Matrix Multiplication	Matrix Multiplication for BIG DATA	2	
7.	Concurrency Control	Concurrency-control mechanisms, Multithreading, Transactions, logging, ACIDcompliant, crash recovery	5	
7.	Graphs	Spanning Tree (Min/Max),Searching (BFS), ShortestPath 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		
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 DataEngineering, ACM Transactions on Intelligent Systems andTechnology (TIST), ACM Transactions on Knowledge Discovery from Data (TKDD)
2.	Tier-1 Conferences: SIGKDD, ICDE - International Conference onData Engineering, CIKM - International Conference on Informationand Knowledge Management, ICDM - IEEE International Conferenceon Data Mining, SDM - SIAM International Conference on DataMining, PKDD - Principles of Data Mining and Knowledge Discovery,IEEE Big Data
3.	Online courses: http://grigory.us/big-data-class.html https://courses.engr.illinois.edu/cs598csc/fa2014/
4.	Book: Mahmoud Parsian, "Data Algorithms: Recipes for Scaling Up withHadoop and Spark", O'Reilly Media, July 2015.

Detailed Syllabus

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-implement-k-nearest-neighbors-in-python-from-scratch/]	2
4.	Clustering	Clustering: Implement kMeans on Following dataset (download it from here).	2
5.	Classification -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+replicated+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.	Comparison of Classification 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

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M11CS112	**Semester Odd (specify Odd/Even)**	**Semester** Odd **Session** 2019 - 20 **Month from** July to December
Subject Name	Machine Learning and Data Mining		
Credits	3	**Contact Hours**	3

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

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.	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	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.	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, Support Vector Machine	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	Back propagation, Feed forward Network, Network training, Error Propagation, Application of Neural Networks. Kohonen Self-Organizing Feature Maps, Learning Vector Quantization	6
8.	Ensemble Methods	Ensemble methods of classification-Bagging, Boosting, and Random Forest	6
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
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
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
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	**Contact Hours**	3-0-0

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

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 theFacebook 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.	EfraimTurban , 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, ICFAIUniversity, 2004.
5.	RS Prasad, "Cyber crime: Combat Strategies", ICFAI Books, ICFAIUniversity, 2004.
6.	RS Prasad, "CRM Present and Future", ICFAI Books, ICFAIUniversity, 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 HaralambosMarmanis, Dmitry Babenko
12.	Recommender Systems: An Introduction DietmarJannach (Author), Markus Zanker (Author), Alexander Felfernig (Author), Gerhard Friedrich
13.	Recommender Systems Handbook Francesco Ricci (Editor), LiorRokach
14.	Recommendation Systems in Software Engineering Martin P. Robillard (Editor), WalidMaalej (Editor), Robert J Walker (Editor), Thomas Zimmermann
15.	Web Analytics 2.0 Avinash Kaushik
16.	Analyzing Social Web JeneffirGolbeg

17.	Predictive Analytics Eric Segel

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		**Marks**
	A. THEORY Examination	
	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
Lecture-wise Breakup

Course Code	14M1NCI339	**Semester Odd (specify Odd/Even)**	**Semester** M.Tech (I) **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 Challenges	Sleep scheduling Models & Analysis, Clustering, Load balancing, Energy Hole and Connectivity Gap problem, Poissonian and Gaussian distributed network	6
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
Lab-wise Breakup

Course Code	**17M15CS111**	**Semester** ODD	**Semester I Session** 2019 -2020 **Month from** July to Dec 2019
Course Name	Advanced Algorithms Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Manish Kumar Thakur
	Teacher(s) (Alphabetically)	Manish Kumar Thakur

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 divide-and-conquer, greedy and dynamic programming strategies, and further recite algorithms that employ these strategies.	Level 3: Apply 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-Fanon coding.	CO2
4.	Dynamic Programming Technique	Fundamentals of Dynamic programming based solution approach, Printing Shortest Common Super sequence, 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.	Mini-Project	Mini-Project	CO6

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.	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	17M15CS113	**Semester** **Odd**	**Semester** I **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 CloudSimand run different scheduling algorithms.	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 Centersusing 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

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.	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 RajkumarBuyya, 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, RajkumarBuyya, 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.	RajkumarBuyya, 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.**

Detailed Syllabus
Lecture-wise Breakup

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)
C130.4	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. VijayalakshmiPai, "Neural Netwoks, Fuzzy Logic, and Genetic Algrithm", PHI Publication
6.	KishanMehrotra, 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

Lecture-wise Breakup

Course Code	**18M11GE111**	**Semester** Odd	**Semester I** **Session** 2019 -2020 Month from 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 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**
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.

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.

Detailed Syllabus

Subject Code	19M12CS111	**Semester odd**	**Semester First Session 2019- 2020** **Month from July to December**
Subject Name	Web Intelligence		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Anuja Arora
	Teacher(s) (Alphabetically)	1. Anuja Arora 2. Neetu sardana

COURSE OUTCOMES		**COGNITIVE LEVELS**
C121.1	Outline the various web technologies, methods, and models used to design an intelligent web.	[understanding Level 2]
C121.2	Make use of web caching strategies at varied level: user, web server, and gateway server.	[Apply Level 3]
C121.3	Analyze and Model the users' browsing behavior on web.	[Apply and Analyse-3,4]
C121.4	Evaluate various Web content mining algorithms and Web language models for Web Applications.	[Evaluate Level 5]
C121.5	Design and develop the computational intelligent web algorithms to handle complex real problems	[Create Level 6]

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Web Content Feature Engineering	Frequency Filter, POS Tag, Unigram, Ngram, Collocation, Levenstein Distance, KL-Divergence, T-Test	2
2	Keyterms Extraction Methods	TF-IDF, SGRank, SGRank-IDF, Single Rank,	3
3	Web Content Searching Techniques	Word-Word occurrence matrix; Probabilistic models: Bayes model, BM25 Ranking model; Word2Vec, CBoW, Skip Gram Model Link Based Search Algorithm , Power Iteration Method for ranking nodes on web, Handling Spider Traps and Dead ends, Topic Sensitive Page Ranking.	8
4	Ranking Algorithm	Point wise ranking, Pair wise Ranking, Listwise ranking, Metrics for Learning to rank : CG, DCG, NDCG, P@K, MAP, AP	3
5	Web caching Algorithm	LRV, FIFO, LRU, Random, OPT	3
6	Matrix Factorization Techniques	Matrix decomposition, Eigenvalue decomposition, Non-Negative matrix factorization, Singular value decomposition, objective functions , UV decomposition, CUR decomposition	3

7	Tensor Factorization	Multidimensional Matrix, Matricization, Tucker decomposition, High Order SVD, clustHOSVD, other methods	3
9	Spamming on Web	Term Spamming, Link Spamming, Combating Link Spam, Google Trust Rank, Spam Mass.	3
10	Advertising on the Web	Issues in On-Line Advertising, Off-line Vs On-Line Algorithms, Greedy Algorithms The Matching Problem and Adwords Problem, The Balance Algorithm	4
11	Web Usage Mining	Introducing Web Logs ,Data Cleaning and Preprocessing :Page view Identification , User Identification, Sessionization, Path Completion ,Data Integration , Cluster Analysis and Visitor Segmentation, Analysis and predictions of Sequential and Navigational Patterns Markov Chains, Modelling web browsing using All Kth Markov chains, Hidden Markov Model, Turney algorithm.	8
		Total number of Lectures	**40**

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.	Liu, Bing. Web data mining. Springer-Verlag Berlin Heidelberg, 2007.
2.	Soumen Chakrabarti,. Mining the Web: Discovering knowledge from hypertext data. Morgan Kaufmann, 2003.
3.	Scime, Anthony, ed. Web mining: applications and techniques. IGI Global, 2005.
4.	Hitzler, Pascal, Markus Krotzsch, and Sebastian Rudolph. Foundations of semantic web technologies. CRC Press, 2011.
5.	King, Andrew B. Website optimization. " O'Reilly Media, Inc.", 2008.
6.	Segaran, Toby. Programming collective intelligence: building smart web 2.0 applications. "O'Reilly Media, Inc.", 2007.
7.	Aggarwal Charu.C, Social Network Data Analytics, Springer Science+Business Media, LLC 2011
8.	*Easley, David, Jon Kleinberg. Networks, Crowds, and Markets: Reasoning about a Highly Connected World. New York, NY: Cambridge University Press, 2010.*
9.	Jackson Matthew O,. Social and Economic Networks. Princeton, NJ: Princeton University Press, 2008
10	Borgatti Stephon. P., Everett Martin G and Johnson Jeffery C , Analyzing Social Networks, Sage Publications, 2013