Detailed Syllabus

Lab-wise Breakup

Course Code	15B19CI791	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 Month from July 2018 – Dec 2018
Course Name	**Major Project Part – 1**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Manish Kumar Thakur
	Teacher(s) (Alphabetically)	All CSE/IT faculty members

COURSE OUTCOMES		**COGNITIVE LEVELS**
C450.1	Summarize the contemporary scholarly literature, activities, and explored tools for hands-on in the respective project area	Understand Level (Level 2)
C450.2	List out the specific requirements to develop the workable solution for the identified computing problem.	Analyze Level (Level 4)
C450.3	Develop a workable computing solutions for the identified problem	Apply Level (Level 3)
C450.4	Evaluate the performance of the developed solution	Evaluate Level (Level 5)
C450.5	Improve the communication and writing skills in terms of presenting the results in written and verbal formats	Create Level (Level 6)

Evaluation Criteria

Components	**Maximum Marks**	…
Mid Semester Project Viva	20	
Final Project Viva	30	
Project Report	20	
Day to Day	30	
Total	**100**	

Detailed Syllabus

Course Code	15129CI793	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 **Month from** July-Dec 2018
Course Name	Summer Training Viva		
Credits	2	**Contact Hours**	…

Faculty (Names)	**Coordinator(s)**	Shardha Porwal
	Teacher(s) (Alphabetically)	Shardha Porwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Summarize the contemporary activities with respect to their module, and explored tools for hands-on in the respective project area	Understand Level (Level-2)
CO2	Analyse industry requirements and work culture	Analyze Level (Level-4)
CO3	Apply technical knowledge to construct computing-based solution with respect to the identified problem at industry/institute.	Apply Level (Level-3)
CO4	Interpret and critically evaluate the solution for the problem.	Evaluate Level (Level-5)
CO5	Create written discourse for presentation of work done at industry/institute.	Create Level (Level-6)

Evaluation Criteria		
Components	**Maximum Marks**	…
Summer viva	**100**	
Total	**100**	

Detailed Syllabus

Subject Code	17B1NCI746	**Semester** ODD **(specify Odd/Even)**	**Semester:** VII **Session:** 2018 - 19 **Month from:** July to Dec 2018
Subject Name	Image Processing		
Credits	**3-1-0**	**Contact Hours**	**4**

Faculty (Names)	**Coordinator(s)**	Dr. Ankit Vidyarthi
	Teacher(s) (Alphabetically)	Dr. Ankit Vidyarthi

Course Objectives: At the completion of this course, students will be able to

CO	Course objective	Cognitive Level
C430-4.1	Demonstrate the fundamental concepts of a digital image processing system	Understand (Level 2)
C430-4.2	Utilize various transformations to analyze images in the frequency domain	Apply (Level 3)
C430-4.3	Identify the techniques for image enhancement and image restoration.	Apply (Level 3)
C430-4.4	Categorize various Image Segmentation Techniques	Analyze (Level 4)
C430-4.5	Inspect various color models and their conversions	Analyze (Level 4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Digital image processing	Elements of Digital Image Processing System, Visual perception and properties of human eye, Image representation, A simple image model, basic relationship between pixels, Image geometry	4
2.	Image Transformation and Frequency domain processing	Introduction to Fourier transform, DFT & FFT, Properties of 2D Fourier Transform, Separable Image Transforms –Walsh, Discrete Cosine Transform, Problems on above	5

		Transforms	
3.	Image Enhancement	Image Enhancement – spatial domain techniques, enhancement through point processing technique, Histogram Manipulation, Mask processing. Image arithmetic:	6
4.	Image Filtering analysis	Filtering/smoothening/removing noise, convolution/correlation, image derivatives, Low pass filtering in frequency domain, High pass filtering in frequency domain, use of high pass filtering in spatial domain or image sharpening	5
5.	Image Restoration	Image degradation, types of image blur, classification of image restoration techniques, image restoration model, performance metric , applications of digital image restoration.	4
6.	Image Segmentation	Classification of image segmentation techniques, Region based approach to image segmentation, Image segmentation based on thresholding, Edge based segmentation, Edge detection, edge linking, Hough transform, Watershed transformation, Shape representation- Chain code, polygonal approximation	7
7.	Binary Image Processing	Binarisation, mathematical morphology, structuring element, logical operations, morphological image processing, erosion, dilation, opening, closing, morphological algorithms, boundary extraction, region filling, extraction of connected components, skeleton.	7
8	Color Image Processing	Light and color, color formation, human perception of color, color models, color-image quantization, histogram of color image, color-image filtering, color image segmentation	5
		Total number of Lectures	**43**
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.	R. Gonzalez and R. Woods , Digital Image Processing, Pearson Education
2.	Jain Anil K. , Fundamentals of digital image processing, PHI
3.	W.K. Pratt, Digital Image Processing, John Wiley
4.	Chanda and Majumdar, Digital Image Processing and Analysis, PHI
5	Rosenfeld A. and A. C. Kak, Digital picture processing, Academic Press, Orlando
6.	Lecture Series of NPTEL

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B1NCI749	**Semester ODD**	**Semester VII Session 2018-2019 Month from JUL to DEC**
Subject Name	MOBILE COMPUTING		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	1. DR. SANJEEV PATEL (J128) 2. MS. ARPITA JATHAV BHATT (J62)
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-4.1	Assess the suitability of different techniques in multiplexing, modulation, spread spectrum, frequency reuse factor for specific wireless network requirements	Evaluate Level (C5)
C431-4.2	Identify important issues and concerns on security and privacy of a mobile computing environment and assess technical solution for security and privacy of user data.	Apply Level (C3)
C431-4.3	Analyze performance aspects of medium accessing, transport layer methodologies and routing techniques in wireless networks (WLAN, WPAN) and mobile networks (GSM, UMTS, UTRAN).	Analyze Level (C4)
C431-4.4	Apply functional aspects of Android mobile operating system in developing mobile applications.	Apply Level (C3)
C431-4.5	Build contemporary mobile applications based on different widgets, different views and view groups, SMS, mail, and location aware services through Internet for mobile environments.	Create Level (C6)
C431-4.6	Explain the working of different protocols for mobile network layer and mobile transport layer.	Understand Level (C2)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Introduction to mobile computing: Applications, mobile and wireless devices, history of wireless communication, open research topics, simplified reference model	3
2.	Wireless Transmission	Frequency for radio transmission, regulation, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular systems	6
3.	Medium Access Control	Specialized MAC, Hidden and exposed terminals, near and far terminals, SDMA, FDMA, TDMA, CDMA., comparison of S/T/F/CDMA	4
4.	Telecommunication Systems	GSM: Mobile Services, System Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, Data Services, UMTS and UTRAN, Core Network, Handover	6
5.	Wireless LAN	Infrastructure and ad-hoc network, IEEE802.11: System architecture, protocol architecture, Physical Layer, Medium access control layer, MAC management, 802.11b, 802.11a,HIPERLAN, Bluetooth	5
6.	Mobile network Layer	Mobile IP, Dynamic host configuration protocol, mobile ad-hoc networks, routing	4
7.	Mobile transport layer	Traditional TCP: congestion control, slow start, fast retransmit/fast recovery, implications of mobility, TCP improvements, TCP over 2.5, 3.5 wireless networks, performance enhancing proxies, Mobility.	4
8.	Mobile Operating Systems	Android OS- Installing, Setup, Getting started, Making and testing Android projects, Basic program	8

		structure, Java-based layout, XML-based layout, Hybrid layout, Project structure summary, Android Programming: running Simple 'Hello World' Applications.	
9.	Research Issues in Wireless and Mobile Computing	Mobile networking, Quality of Service in Mobile Networks, Mobile access to World-Wide-Web, Mobile Data Management, Mobile Transactions, Mobile Computing Models	2
		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.	Jochen Schiller, "Mobile Communications", second edition, Addison-Wesley, 2004.
2.	Stojmenovic, and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
3.	Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, 2004.
4.	Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional, 2005
5.	Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, second edition, 2003.
6.	Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.
7.	Raj Kamal, "Mobile Computing", first edition, Oxford University Press, 2007.
8.	Asoke K Talukder, and Roopa R. Yavagal, "Mobile Computing: Technology, Application and Service Creation", Tata McGraw-Hill Professional, 2005
9.	Abdelsalam Helal, "Any Time, Anywhere Computing: Mobile Computing Concepts

	and Technology", Kluwer Academic Publishers, 1999.
10.	IEEE Transaction on Broadcasting
11.	IEEE Transaction on Communication
12.	IEEE Transaction on Computers
13.	IEEE Transaction on VT
14.	IEEE Communication Letters

Syllabus Description

Course Code **NBA Code:**	17B2NCI731 432.6	**Semester** Odd	**Semester VII Session** 2018 - 19 **Month from** July '18 **to** Dec '18
Subject Name	Computer Graphics		
Credits	3	**Contact Hours**	3-1-0

Faculty	**Coordinator**	Dr. Suma Dawn / Gaurav Kumar Nigam
	Teacher(s)	Dr. Suma Dawn / Gaurav Kumar Nigam

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-6.1	Explain the basics and core concepts of computer graphics including different graphics systems, usage of GPUs, applications of computer graphics, and others.	Understanding Level (Level 2)
C432-6.2	Compose scenes by applying common 2D & 3D graphics algorithms such as, viewing transformations, clipping, projections, rendering, etc. using OpenGL.	Creating Level (Level 6)
C432-6.3	Analyze models for lighting – distant and multiple light sources; reflection and models for shading – flat, smooth, Phong, etc.	Analyzing Level (Level 4)
C432-6.4	Demonstrate the use of planer and surface curves, and use of visible surface detection methods for scene presentation.	Understanding Level (Level 2)
C432-6.5	Explain animation and key framing.	Understanding Level (Level 2)
C432-6.6	Interpret and critique procedural modelling, fractals, and particle systems and critique existing systems.	Evaluating Level (Level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for**

			the module
1.	Introduction	Context, Requirements, and Application: History of computer graphics, graphics architectures and software, imaging: pinhole camera, human vision, synthetic camera, modeling vs rendering.	3
2.	Graphics Pipeline and Hardware	Display Unit, Frame buffer, DPU, GPU	2
3.	Raster Graphics & related Data structures	Line, circle, ellipse, polygon, Area filling; Rasterization: line drawing via Bresenham's algorithm, clipping, polygonal fill; Introduction to hidden surface removal (z buffer);	10
4.	Colours	Color perception, color models (RGB, CMY, HLS), color transformations. Color in OpenGL. RGB and Indexed color;	3
5.	2D and 3D Planer and Curved objects	Data structures for modeling; Algorithms for Mesh generation, Clipping, 2D and 3D; Geometric Transformations, and so on; Geometric transformations: affine transformations (translation, rotation, scaling, shear), homogeneous coordinates, concatenation, current transformation and matrix stacks; Three dimensional graphics: classical three dimensional viewing, specifying views, affine transformation in 3D, projective transformations;	10
6.	Rendering	Data Structures, Algorithms and hardware support; Ray Tracing; Shading: illumination and surface modeling, Phong shading model, polygon shading; Discrete Techniques: buffers, reading and writing bitmaps and pixelmaps, texture mapping, compositing;	10
7.	Animation	Introduction to animation and keyframing; vector-based animations	2
8.	Procedural modeling	Fractals and particle systems	4
		Total number of Lectures	**44**

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

Recommended Reading material: (APA format)	
1.	Foley, J. D., Dam, A. V., Feiner, S. K., Hughes, J. F., & Carter, M. P. (1997). Computer graphics: Principles and practice, in c. *Color Research and Application*, *22*(1), 65-65.
2.	Marschner, S., & Shirley, P. (2015). *Fundamentals of computer graphics*. CRC Press.
3.	Hearn, D., & Baker, M. P. (1997). Computer graphics, C version.
4.	Angel, E. (1997). *Interactive Computer Graphics: A top-down approach with OpenGL* (Vol. 2). Addison-Wesley.
5.	Hill Jr, F. S. (2008). *Computer graphics using open gl*. Pearson education.
6.	Rogers, D. F. (1986). *Procedural elements for computer graphics*. McGraw-Hill, Inc..
7.	Newman, W. M., & Sproull, R. F. (1979). *Principles of interactive computer graphics*. McGraw-Hill, Inc..
8.	ACM Transactions on Graphics
9.	IEEE Transactions on Visualization and Computer Graphics

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

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

Course Code	17B1NCI736	**Semester** ODD **(specify Odd/Even)**	**Semester** VII **Session** 2018-2019 Month from July 2018
Course Name	Bioinformatics Algorithms		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Mr. PrantikBiswas
	Teacher(s) (Alphabetically)	Mr.PrantikBiswas, Dr.Aparajita Nanda

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-1.1	Relate to different computational challenges in Computational Molecular Biology.	Level-2
C432-1.2	Examine proper algorithmic concepts to solve a computational problem.	Level-4
C432-1.3	Determine the importance of traditional to contemporary approaches for solving the biological problems.	Level-5
C432-1.4	Design strategy to resolve real-world biological challenges.	Level-6
C432-1.5	Identify appropriate algorithmic technique to solve a given bioinformatics related task.	Level-3
C432-1.6	Develop an optimized solution model for computational biology problems.	Level-6
C432-1.7	Formulate prediction tools and estimate the solutions for biological problems.	Level-6

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**

1	Algorithms and Complexity	Introduction, Biological Algorithms versus Computer Algorithms, The Change Problem, Comparative Analysis of Various Classes of Algorithms.	2
2	Molecular Biology	Introduction, Structure of Genetic Materials, Structural Formation of Proteins, Information Passage Between DNA and Proteins, Evaluation of Bioinformatics.	3
3	Exhaustive Search	Restriction Mapping, Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, Profiles, Search Trees, Finding Motifs, Finding a Median String.	4
4	Greedy Algorithms	Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, Breakpoints: A Different Face of Greed, A Greedy Approach to Motif Finding.	3
5	Dynamic Programming Algorithms	Classical Problems: DNA Sequence Comparison, The Manhattan Tourist Problem, etc, Edit Distance and Alignments, Global Sequence Alignment, Scoring Alignments, Local Sequence Alignment, Alignment with Gap Penalties, Multiple Alignment, Gene Prediction, Statistical Approaches to Gene Prediction, Similarity-Based Approaches to Gene Prediction, Spliced Alignment.	7
6	Divide-and-Conquer Algorithms	Divide-and-Conquer Approach to Sorting, Space-Efficient Sequence Alignment, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time.	4
7	Graph Algorithms	Graphs and Genetics, DNA Sequencing, Shortest Superstring Problem, DNA Arrays as an Alternative Sequencing Technique, Sequencing by Hybridization, SBH as a Hamiltonian Path Problem, SBH as an Eulerian Path Problem, Fragment Assembly in DNA Sequencing, Protein Sequencing and Identification, The Peptide Sequencing Problem, Spectrum Graphs, Protein Identification via Database Search, Spectral Convolution, Spectral Alignment.	8
8	Combinatorial Pattern Matching	Repeat Finding, Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms, Approximate Pattern Matching	4
9	Clustering and Trees	Hierarchical Clustering, k-Means Clustering, Evolutionary Trees, Distance-Based Tree Reconstruction, Reconstructing Trees from Additive Matrices, Evolutionary Trees and Hierarchical Clustering, Character-Based Tree Reconstruction	3
10	Applications	BLAST: Comparing a Sequence against a Database; The	4

		Motif Finding Problem, Gene Expression Analysis, Clustering and Corrupted Cliques, Small and Large Parsimony Problem, Hidden Markov Models, Randomized Algorithms	
		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	Jones, N. C., &Pevzner, P. (2004). *An introduction to bioinformatics algorithms*. MIT press.
2	Schölkopf, B., Tsuda, K., &Vert, J. P. (2004). *Kernel methods in computational biology*. MIT press.
3	Jiang, T., Xu, Y., & Zhang, M. Q. (2002). *Current topics in computational molecular biology*. MIT Press.
4	Pevzner, P. (2000). *Computational molecular biology: an algorithmic approach*. MIT press.
5	Gusfield, D. (1997). *Algorithms on strings, trees and sequences: computer science and computational biology*. Cambridge university press.
6	Lesk, A. (2013). *Introduction to bioinformatics*. Oxford University Press.
7	Gollery, M. (2005). Bioinformatics: Sequence and Genome Analysis, David W. Mount. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 2004, 692 pp., ISBN 0-87969-712-1. *Clinical Chemistry*, *51*(11), 2219-2219.
8	Cormen, T. H. (2009). *Introduction to algorithms*. MIT press.
9	*IEEE/ACM Transactions on Computational Biology and Bioinformatics*
10	*Bioinformatics* , https://academic.oup.com/bioinformatics
11	Nature Communications, http://www.nature.com/ncomms/

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B1NCI748	**Semester Odd**	**Semester** VII **Session** 2018 -2019 Month from: July to December 2018
Subject Name	Graph Algorithms and Applications		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Dr Manish Kumar Thakur Dr. Mukta Goyal
	Teacher(s) (Alphabetically)	Dr Manish Kumar Thakur Dr. Mukta Goyal

S. N.	**Course Outcome**	**Cognitive Level (Bloom's Taxonomy)**
C431-1.1	Find the shortest path, minimum spanning tree, maximum flow, articulation points, bridges, etc. in the given weighted or unweighted graph	Remembering (Level-1)
C431-1.2	Model the real world computational problems using graph	Understanding (Level-2)
C431-1.3	Apply conventional, approximation and evolutionary algorithmic approaches for graph based computational problems like, covering problems, bipartite set matching,	Applying (Level-3)
C431-1.4	Develop computing solutions for the real world computational problems modelled using graph	Creating (Level-6)
C431-1.5	Analyze the time and space complexities of the designed algorithms and developed solutions for the computational	Evaluating (Level-5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Scope, Basic concepts and terminology, Adjacency Matrix, Incidence Matrix, Cycle Matrix, Cut-set Matrix, Path Matrix, Determining lower bounds, Adversary arguments, Problem reductions, NP-completeness, etc.	1
2.	Applications of	Reliable communication network design, Cycle	5

	Connectivity	detection, Searches, Multiway cut, Minimum K-cut, etc.	
3.	Applications of Traversability	Shortest paths, Optimal tours, Euler's Cycle, Hamiltonian Cycle, TSP, etc.	4
4.	Applications of Trees	Spanning trees, Steiner Tree, Minimum cost constructions, Coding theory, Phylogeny construction, etc.	4
5.	Applications of Matching/Partitioning	Personnel assignment, Optimal assignment, Hungarian Algorithm, Territory demarcation, Stable Marriage, Project Allocation, etc.	5
6.	Applications of Coverings	Vertex Cover, Set Cover, Shortest superstring, Geometric problems, etc.	3
7.	Applications of Colourability	Storage management, Timetable schedules, etc.	3
8.	Applications of Planarity	Planarity detection, PCB design, Facilities layout and floor plan design, Software testing, Defense strategies, etc.	4
9.	Applications of Digraphs	Circuit theory and electrical network analysis, Transport networks, Job sequencing, Disk scheduling, Participant rankings in tournaments, Choice consistency, Project planning, etc.	4
10.	Applications of Flows	Max-flow min-cut, Feasible flows, Transportation problems, etc.	4
11.	Graph Databases	*Embrace Relationships with Graph Databases, Querying Graphs: Cypher Query Language, Graph Database Application*	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Marks - Punctuality, 5 Marks - Assignment, 15 Marks - Mini-project)
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.	Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall, 1974
2.	Frank Harary, Graph Theory, Addison-Wesley, 1969
3.	Reinhard Diestel, Graph Theory, 3e, Springer-Verlag, 2005
4.	Kenneth H. Rosen, Discrete Mathematics and its Applications, 6e, McGraw-Hill, 2007
5.	Thomas H Cormen, Charles E Leiserson, Ronald L. Rivest, and Cliff Stein, Introduction to Algorithms, 2e, MIT Press, 2001
6.	A Gibbons, Algorithmic Graph Theory, Cambridge University Press, 1985
7.	V. A. Vazirani, Approximation Algorithms, Springer International Edition

Detailed Syllabus

Course Code	**18B12CS434**	**Semester Odd**	**Semester** VII **Session** 2018 -2019 Month from July - December
Course Name	Ethical Hacking		
Credits	3	**Contact Hours**	3-1-0

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-1.1	Define what is ethical hacking and penetration testing, and when and why penetration testing is required along with testing phases.	Remember Level (Level 1)
C431-1.2	Classify and outline the penetration testing phases and relate the phases to the specified context.	Understand Level (Level 2)
C431-1.3	Identify and analyse the stages a penetration tester requires to take in order to compromise a target system.	Apply Level (Level 3)
C431-1.4	Examine and implement tools and techniques to carry out a penetration testing.	Analyze Level (Level 4)
C431-1.5	Critically evaluate security techniques used to protect system and user data to suggest countermeasures.	Evaluate Level (Level 5)
C431-1.6	Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system.	Create Level (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Unit -1 Ethics and Legality	Networking and security and areas of security like Applicationsecureity, Web security, Network security, Privileges, Foot Printing, scanning virus and worms. Understand 18 U.S.C. § 1030 US Federal Law, Understand the legal implications of hacking.	6

2.	Unit 2: Scanning	Define the terms port scanning, network scanning, and vulnerability scanning, Understand the CEH scanning methodology, Understand Ping Sweep techniques Understand nmap command switche,s Understand SYN, Stealth, XMAS, NULL, IDLE, and FIN scans List TCP communication flag types ,Understand war dialing techniques ,Understand banner grabbing and OF fingerprinting techniques , Understand how proxy servers are used in launching an attack ,How do anonymizers work? , Understand HTTP tunnelingtechniques , Understand IP spoofing techniques.	6
3.	Unit 3: Trojans and Backdoors	Understanding Netcat, Trojan, Wrapping, Trojan Evading techniques.	6
4.	Unit 4: Sniffers	ARP poisoning, Wireless Sniffers, mac flooding, DNS spoofing, IP spoofing.	6
5.	Unit 5: Web servers	Web application vulnerabilities, hacking web servers, SQL-Injections.	6
6.	Unit 6: Virus and worms	Linux hacking, virus and worms,Evading IDS, Firewalls, Reverse shell.	6
7.	Unit 7: Mobile Security	Detecting infected APKs, securing Bluetooth	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz/project 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.	Kimberly Graves, CEH certifited ethical hacking, 2015, Wiley publication.
2.	Alper, Al. "Revealed! The Secrets to Protecting Yourself from Cyber-Criminals", Lulu. com, 2016
3.	Wright, Joshua, and Johnny Cache. "Hacking exposed wireless: wireless security secrets & solutions". McGraw-Hill Education Group, 2015.
4.	Engebretson, Patrick, "The basics of hacking and penetration testing: ethical hacking and penetration

	testing made easy", Elsevier, 2013
5.	Cannings, Rich, HimanshuDwivedi, and Zane Lackey. Hacking exposed web 2.0: Web 2.0 security secrets and solutions. McGraw Hill, 2008

Detailed Syllabus

Lecture-wise Breakup

Subject Code	15B1NCI738	**Semester : Odd**	**Semester VII Session 2018- 2019 Month from July to December**
Subject Name	Social Network Analysis		
Credits	**3**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	3. Dr. Neetu Sardana
	Teacher(s) (Alphabetically)	1. Dr. Anuja Arora 2. Dr. Neetu Sardana 3.Somya Jain

SLNO	Course objectives:	COGNITIVE LEVEL (BLOOMS TAXONOMY)
C431-2.1	Define social network growth models and their characteristics.	Remember level (Level 1)
C431-2.2	Compare and interpret social network structure, size and its connectivity pattern using degree distribution, clustering coefficient, centrality, motifs, density, etc.	Understand Level (Level 2)
C431-2.3	Apply link prediction techniques like Jaccard Coefficient, Adamic Adar, Preferential attachment, Katz score, etc. to discover new links in the social network.	Apply Level (Level 3)
C431-2.4	Discover community structure in complex network using statistical techniques like Newman Girvan, Clique Percolation Method, Ford Fulkerman etc.	Analyse Level (Level 4)
C431-2.5	Model the cascading/flow of information in social network for maximizing the cascade, locating the seed nodes and influential nodes.	Apply Level (Level 3)
C431-2.6	Develop secured social networks by applying mechanisms like K-anonymity, L-diversity, T-closeness, etc. to ensure privacy and security.	Apply Level (Level 3)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Concepts: how services such as Facebook, LinkedIn, Twitter, etc. are using SNA to understand their users and improve their functionality.	2
2.	Network Concept	Introduction: Graphs, Paths and components, Adjacency Matrices, Ways and Modes, Matrix Product, node degree, types of nodes and types of ties, actor atributes	4
3.	Random network models	Erdos-Renyi , Barabasi-Albert , Watts-Strogatz small-world model, shortest path, six degree of separation	5
4.	Social Network Visualization	Tools: Gephi, NetLogo, Pajek, EgoNet	2
5.	Characterizing whole network	Cohesion, reciprocity, Transitivity and clustering Coefficient, Triad census	2
6.	Network centrality	Undirected Non-valued networks: Degree, Eigenvector, betweeness.Directed Non-valued Networks: Degree, Eigenvector, closeness. Valued Networks,Negative tie Networks, subgroup: Cliques and groups	5
7.	Community Detection	clustering, community structure, modularity, overlapping communities	5
8.	Link Prediction	The Katz Score, Hitting & Commute Time, Rooted PageRank, SimRank, Predictors Summary, Meta-measures	5
9.	Information Diffusion	Cascading Behavior: Herd Behaviour, Information Cascade Model, Threshold Model, Cascade Maximization, Epidemic Modeling	5
10.	Security and Privacy in Social Network	Introduction, K-Anonymity, L-Diversity, Q-Anon, T- Closeness	6
		Total number of Lectures	**41**

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.	Chakrabarti, Soumen. 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.	Charu.C. Aggarwal, 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

Detailed Syllabus

Course Code	18B12CS437	**Semester Odd**	**Semester VII Session** 2018 -2019 Month from July to Dec
Course Name	Large Scale Database Systems		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	InduChawla
	Teacher(s) (Alphabetically)	InduChawla, ParmeetKaur

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-3.1	Infer the background processes involved in queries and transactions, and explain how these impact on database operation and design	Understand level (Level 2)
C432-3.2	Explain the concept and challenge of big data and demonstrate the comparison of relational database systems with NoSQL databases	Understand level (Level 2)
C432-3.3	Compare and discover the suitability of appropriate large databases to manage, store, query, and analyze various form of big data	Analyze level (Level4)
C432-3.4	Apply techniques for data fragmentation, replication, and allocation to design a distributed or parallel database system	Apply Level (Level3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to large scale Databases	Review of database systems, modelling and query languages	2
2.	Query processing and Optimization	Query planning, evaluation and optimization	6

3.	Transaction processing	Transaction processing, Concurrency control techniques, ACID rules	4
4.	Overview of Big Data	Introduction to Big Data and the four dimensions of Big Data: volume, velocity, variety, veracity. Big data sources, types and applications, CAP Theorem (consistency, availability, partition tolerance)	5
5.	Storage and Indexing	Data storage and indexing of massive databases in databases and data warehouses. Introduction to technologies for handling big data, NOSQL databases	7
6.	Basics of Hadoop	Introduction to Hadoop, Configu - -ring a Hadoop Development Environment, HDFS Architecture, HDFS Programming Fundamentals, Analyzing big data with Hadoop,MapReduce Architecture, MapReduce Programming	4
7.	Application-driven databases	Parallel and Distributed databases, Distributed Database Design, Architecture of Distributed DBMS	8
8.	Distributed and parallel Query Processing	Query Processing , Distributed Query Optimization, Parallel Query Processing and Optimization	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.	Henry F Korth, Abraham Silberschatz, S. Sudurshan, Database system concepts, 5th Edition, McGraw-Hill,2006
2.	RamezElmasri ,Shamkant B. Navathe, Fundamentals of Database Systems, 4th Edition, Pearson Education, 2006.
3.	Sadalage, P.J. &Foowlwer, M. 2013. NoSQL distilled : a brief guide to the emerging world of polygot persistence. Addison-Wesley

4.	White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.
5.	Zikopoulos, Paul, and Chris Eaton. Understanding big data: Analytics for enterprise class hadoop and streaming data. McGraw-Hill Osborne Media, 2011.
6.	ShashankTiwari, Professional NoSQL, Wiley, 2011

Detailed Syllabus

Course Code	17B1NCI732	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 Month from July 2018- Dec 2018
Course Name	Computer and Web Security		
Credits	3	**Contact Hours**	3-1-0

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-5.1	Describe Vulnerability-Threat-Control Paradigm for assessing computing system's security challenges	Understand (Level-2)
C430-5.2	Explain Unintentional Software Security Issues and their solutions	Understand (Level-2)
C430-5.3	Evaluate various malware detection systems	Analyze (Level-4)
C430-5.4	Identify client-side web access threats like cross site scripting and SQL injection	Apply (Level-3)
C430-5.5	Apply mechanisms of correct Identification and Authentication for access control of computing resources	Apply (Level-3)
C430-5.6	Examine non-cryptographic network protocol vulnerabilities and their solutions	Analyze(Level-4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Vulnerability-Threat-Control Paradigm	Threats: Confidentiality, Integrity, Availability, Types of Threats, Types of Attackers, Software Security: Buffer Overflow, Coding threats	3
2.	Software Security Issues	Unintentional insecure Coding Practices, Buffer Overflow, Format String vulnerabilities, Stack Smashing	6
3.	Malware	Virus, Worms – Definition , Modelling and Solutions	5
4.	Malware Detection systems	Worm Detection, Worm Signature Extraction, Virus Detection, Intrusion Detection Systems – Anomaly Vs	4

		Signature Based and Host vs Network Based	
5.	Web Access Threats	Web Browser Attacks: Browser Attack Types, Web Attacks Targeting Users, Obtaining User or Website Data, Code within Data, Foiling Data Attacks, Email Attacks: Phishing	7
6.	Access Control -1	Access Control and Authorization in OS	4
7.	Access Control -2	Authentication Protocols	4
8.	Non-Cryptographic network protocol vulnerabilities	Threats to Network Communications, Denial of Service: Flooding Attacks, Network Flooding Caused by Malicious Code, Network Flooding by Resource Exhaustion, Denial of Service by Addressing Failures, Traffic Redirection, DNS Attacks, Exploiting Known Vulnerabilities Distributed Denial-of-Service: Scripted Denial-of-Service Attacks,Bots, Botnets	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Tut(5) + Attendance(5) +Quiz(5)+Mini Project(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.	Security in Computing 5th Edition , Charles P Fleeger et. al. , Prentice Hall
2.	Information Security, Principles and Practice, Mark Stamp, Wiley
3.	Kali Linux, Abhinav Singh, Packt Publishing
4.	Computer Viruses and Malware, John Aycock, Springer
5.	Computer Security: Art and Science, Matt Bishop, Addison Wesley

Detailed Syllabus

Lecture-wise Breakup

Course Code	17B1NMA731	**Semester Odd** **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 **Month from** July 2018-Dec. 2018
Course Name	Applied Linear Algebra		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**	Dr. R. C. Mittal	
	Teacher(s) (Alphabetically)	Dr. R. C. Mittal	

COURSE OUTCOMES : After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C401-7.1	explain field, vectors, vector spaces and their dimensions.	Understanding level (C2)
C401-7.2	apply linear transformations in solving practical engineering problems.	Applying Level (C3)
C401-7.3	develop the concept of rank, determinant, existence and uniqueness of solution of a system of linear equations.	Applying Level (C3)
C401-7.4	explain the concept of length, distance and inner-product.	Understanding level (C2)
C401-7.5	apply the concept of orthogonality and orthogonal matrices to orthogonalize a set of linearly independent vectors.	Applying Level (C3)
C401-7.5	analyze eigenvalues, eigenvectors and their properties to solve a system of ordinary differential equations.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Vector Space and Dimension	Field, Vector Space, Vector subspace, linear dependence and independence, Span of a set, Dimension of a vector space, Direct Sum and Complement	7
2.	Linear Transformation I	Linear Transformation and its algebra, and its matrix representation, homomorphism, isomorphism, rank and null subspace, rank-nullity theorem, Solution of a system of Linear Equations, Determinant	7

3.	Linear Transformation II	Change of basis, Inverse of a linear transformation, Linear functional, transpose	5
4.	Inner Product and Metric	Inner product space, Metric and normed spaces. Orthonormal basis, Orthogonal Subspaces, Gram-Schmidt orthogonalization.	8
5.	Eigen Values and Eigen Vectors	Eigen values and Eigenvectors, Modal matrix and diagonalization, Similarity Transformation, Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices	9
6.	Applications of Linear Algebra	Bilinear and Quadratic forms, Positive definite matrices, Norm of a matrix, Condition number,Application to find solutions of ordinary differential equations	6
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Quizzes)
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.	**Hoffman, K and Kunze, R.** , Linear Algebra, Fourth Edition, Prentice Hall of India, 2005
2.	**Strang, G**., Linear Algebra and its Applications, 3rd Ed., 1998
3.	**Noble, B. and Daniel, J.** , Applied Linear Algebra, Prentice Hall of India, 2000
4.	**Lipshutz, S. and Lipsom, M. ,** Linear Algebra, 3rd Edition, Schaum Series, 2001
5.	**Krishnamurthy, V., Mainra, V. P., and Arora, J. L.** , An Introduction to Linear Algebra, Affilated East-West, 1976

Detailed Syllabus

Subject Code	**18B12CS435**	**Semester Odd**	**Semester VII Session** 2018 - 19 **Month from July to Dec**
Subject Name	Open Data Centric Services		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Dr. GagandeepKaur
	Teacher(s) (Alphabetically)	1. Dr. GagandeepKaur 2. Sarishty Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-5.1	Understand facts and concepts of open data, open govt. data by comparing & interpreting linked data.	Understand Level (Level 2)
C431-5.2	Apply RDF and Silk frameworks to create, interlink and publish linked data repositories.	Apply Level (Level 3)
C431-5.3	Create & implement RESTful API enabled data resource objects using Python Libraries.	Evaluate Level (Level 5)
C431-5.4	Plan various phases of data cleaning, preprocessing, transforming, analysis and prediction	Apply Level (Level 3)
C431-5.5	Choose open data statistical and predictive analysis techniques to perform static and dynamic data plotting and visualization	Evaluate Level (Level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the**

			module
1.	Introduction to Open Data	Open data concepts, open government data initiatives, challenges, open data infrastructures,	4
2.	Role of Open Data	Linking Open Government Data , linked open data, multidimensional linked open data, providing open data;	10
3.	Open Data Frameworks	RDF and SILK frameworks, Using the Silk API , Silk Server , Silk Workbench , SILK integration with SPARQL Endpoint, open data protocol, RESTful Interface and Open Data APIs, Queries with the REST API	8
4.	Open Data Analysis	Open data aggregation; Resource Association, Resource Aggregation, Composition & Aggregation , Manipulating aggregate resources in a REST API, Aggregation Functions, Representing non-resourceful aggregated data and integration, open data statistical analytics, Aggregate Statistics, SILK Transformation and Aggregation, Linked Statistical Data Analysis, fetching analysis data, applying statistical functions for analysis, Update and return analysis, predictive analysis,	8
5.	Open Data Visualization	open data visualizations, Linked Data Visualization, Challenges for Linked Data visualization, Challenges for Open Linked Data visualization, Classification of visualization techniques	8
6.	Protégé based Open Data Design	Designing ontologies using Protégé, Steps in ontology development process, Use of semantic web technology Sparql, OWL Querying, Entities/Classes Ontology driven application development , Introduction to Ontology, Introduction to OWL, Developing an Ontology in Protégé OWL - Classes and Properties , Developing an Ontology in Protégé OWL - Axioms and Restrictions, SPARQL Query Language for RDF , Protégé Ontology case studies	4
			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.	Linked Open Data: The Essentials A Quick Start Guide for Decision Makers, Florian Bauer, Martin Kaltenböck
2	Silk Link Discovery Framework for the web of data, Julius Volz. Et. al.
3.	Open Government Data, https://data.gov.in/
4.	Ontologies and the Semantic Web. Grimm S., Abecker A., Völker J., Studer R. (2011) In: Domingue J., Fensel D., Hendler J.A. (eds) Handbook of Semantic Web Technologies. Springer, Berlin, Heidelberg
5.	Ubaldi, B. (2013), "Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives", *OECD Working Papers on Public Governance*, No. 22, OECD Publishing.
6.	Algemili, U. A. (2016). Outstanding Challenges in Recent Open Government Data Initiatives. *International Journal of e-Education, e-Business, e-Management and e-Learning*, *6*(2), 91.
7.	Bob DuCharme, "Learning SPARQL", O'Reilly
8.	Protégé Tool, *https://protege.stanford.edu/*
9.	IEEE, ACM Transactions, Journals and Conference papers on Semantic web

Detailed Syllabus

Course Code	18B12CS439	**Semester Odd**	**Semester VII Session** 2018 -2019 Month from July to Dec, 2018
Course Name	Cloud Computing and Internet of Things		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Dr. Prakash Kumar
	Teacher(s) (Alphabetically)	1. Dr.Prakash Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-1.1	Understand various Cloud Service Models and Virtualization Technology to Create Virtual Machines for cloud based applications using Virtual Machine Monitors (VMMs).	Understanding (Level 2)
C430-1.2	Analyze various VM migration techniques and their performancesin cloud environments.	Analyze Level (Level 4)
C430-1.3	Optimize the performances of VMs for application specific cloud environments.	Create Level (Level 6)
C430-1.4	Understanding and Modeling of Process, Domain, Information and Service specifications for IoT devices.	Apply Level (Level 3)
C430-1.5	Create functional blocks and use the layer-wise communication protocols based on technological requirements for IoT devices	Create Level (Level 6)
C430-1.6	Design and implement various applications on cloud and IoT models for sustainable development.	Create Level (Level 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Overview of Distributed Computing	Trends of computing, Introduction to distributed computing, System models for Distributed and Cloud Computing, Enabling Technologies.	2
2.	Introduction to Cloud Computing , Issues and Challenges, Cloud Architecture	What's cloud computing, Characteristics andbenefits of cloud computing, Service Models, Deployment models. challenges of cloud computing, Cloud Architecture	3
3.	Virtualization Techniques	Role of Virtualization in Cloud Computing, Virtualization Technologies, Virtual Machines Monitors (VMM), Virtualization Techniques, Virtualization of resources and related issues.	8
4.	Web Services for Cloud Environments	Web Services and their approach to Distributed Computing, Web Services Technologies, Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), Universal Description Discovery and Integration (UDDI).	5
5.	Cloud Security and Data Management	Network level security, Data level security, Access management and control, Authentication,Managing data-storage & processing in Cloud.	5
	Introduction to IoT	Characteristics, Physical and Logical Design of IoT, Enabling Technologies	4
6.	IoT Platform Design Methodology	Generic Design methodologies for IoT, Design of Process, Domain and Information Models for IoT, Design as per Functional and Operational views. Component Integration and Development of Applications for Sustainable computing.	4
7.	Protocols and Technologies for IoT	IoT Protocols and Technologies, 802.15.4, 6LoWPan. ZigBee.	6
8.	Roles for Cloud and IoT for Green and Sustainable Computing,	Energy aware computing in Cloud Environments and IoTs, Roles and Opportunities for Cloud and IoT for meeting Sustainability Challenges.	5
			42

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Presentations of assigned topics)
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.	Tanenbaum, A.S, Marten, V. Steen, Distributed Systems : Principles and Paradigms, 2nd Edition, Prentice Hall .
3.	M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, 1st Ed., Tata McGraw-Hill, 1994.
4.	"Introduction to Cloud Computing Architecture" Sun's White Paper, 1st Edition, June, 2009.
5.	Tanenbaum, A. S Distributed Operating Systems, 1st Ed., Prentice-Hall, Englewood Cliffs, NJ, 1995.
6.	Sanderson, Dan, Programming Google's Application Engine, O'Reilly, Google Press.
7.	IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud Computing."
8.	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.
9.	"Virtualization Overview", White paper, VM Ware.
10.	"Implementing Virtualization" White paper, Intel virtualization Technology, 2008
11.	Tulloch, Mitch, Understanding Microsoft virtualization solutions: From the Desktop to Data Center, Microsoft Press.

Detailed Syllabus

Course Code	18B12CS436	**Semester** ODD	**Semester** VII **Session** 2018 -2019 Month July 2018- December 2018
Course Name	Software Construction		
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**
C431-6.1	Choose appropriate fundamental element of software construction for an actual software development.	Remembering Level (Level 1)
C431-6.2	Apply various Assertion, Error-Handling, Exceptions techniques for defensive programming.	Apply Level (Level 3)
C431-6.3	Make use of appropriate coding standards and conventions of code construction at class routines, variables, and statements level.	Apply Level (Level 3)
C431-6.4	Experiment with code improvement strategies like Code Refactoring, Code Optimisation and Tuning.	Apply Level (Level 3)
C431-6.5	Demonstrate use of software construction techniques like parameterisation, debugging and tools for GUI builders, unit testing , profiling, performance analysis and slicing .	Understanding Level (Level 2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fundamentals of software construction	What and Why Software Construction, Construction Decisions, Design in Construction, Software Metaphors use and importance, Code Quality, Managing Construction, Practical Considerations, Metaphors for Software development.	3

2.	Code Construction	Design in Construction, Class Design and Working Classes, High-Quality Routines. Variables, Statements, Pseudo code Programming Process, limiting dependencies, Meta Programming	6
3.	Defensive Programming	Protecting Your Program from Invalid Inputs, Assertion, Error-Handling, Exceptions, Protecting Code from damage caused by errors, Debugging Aids, Determining How Much Defensive Programming to Leave in Production Code	8
4.	Code Improvements	Debugging, Code Refactoring, Code Optimisation and Tunning strategies and techniques	7
5.	Code Analysis	Tracing, Static and Dynamic analysis	3
6.	Source Code Control	Version Control, CVS, working and organising source tree, branching ,Jump start with Git	6
7.	Scaling Code	Parameterization and Generics, Internationalization of code, Securing Code	6
8.	Build , Test and Release code	Development Environments, GUI Builders, Unit Testing Tools, Profiling, Performance Analysis, and Slicing	3
		Total number of Lectures	**42**

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.	Maguire, Steve, Writing Solid Code – Microsoft's Techniques for Developing Bug-Free C Software. Microsoft Press, 1993.
2.	McConnell, Steve, Code Complete: A Practical Handbook of Software Construction. Microsoft Press, 1993.
3.	Meyer, Bertrand, Object-Oriented Software Construction (Second Edition). Prentice-Hall, 1997.
4.	Warren, Nigel, and Bishop, Philip, Java in Practice – Design Styles and Idioms for Effective Java. Addison-Wesley, 1999.
5.	Fowler, Martin, Refactoring – Improving the Design of Existing Code. Addison-Wesley, 1999.
6.	Writing solid code : Maguire, Steve. LeBlanc, David. Publisher: Bangalore WP Publishers & Distributors Pvt. 2001

Detailed Syllabus

Course Code	16B1NCI833	**Semester ODD (specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 Month from: July 2018 to December 2018
Course Name	Nature Inspired Computing		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr.AnkitaVerma
	Teacher(s) (Alphabetically)	Dr.AnkitaVerma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-4.1	Explain the concepts of problem solving via search, optimization and pattern recognition with various practical examples.	Understand Level (C2)
C432-4.2	Apply the NIC methods to model, learn and optimize computing problems.	Apply Level (C3)
C432-4.3	Analyze the key ideas, algorithmic steps of various nature inspired computing methods and their general applicability in various domains.	Analyze Level (C4)
C432-4.4	Compare and contrast the similarities and differences among various nature inspired computing methods.	Evaluate Level (C5)
C432-4.5	Formulate and design an efficient solution to a given problem by using the most appropriate nature inspired computing method.	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Introduction to Nature Inspired Computing: Need and Motivation behind Nature Inspired Algorithms; Problem solving by Search and Optimization;	5

		Optimization: Continuous vs Combinatorial optimization, Single objective vs Multi-objective optimization, Implicit vs Explicit Constraints; Pattern Recognition.	
2.	Heuristic Search Algorithms	Heuristics and Meta-heuristics; Problem Spaces: States, goals and operators; Heuristics search: Hill Climbing and Simulated Annealing.	3
3.	Evolutionary Algorithms (EA)	Genetic Algorithms: Introduction, Motivation, Basic Terminology, General framework; Encoding Techniques: Binary Encoding, Value Encoding, Permutation Encoding and Tree Encoding); Selection Operators: Fitness Proportionate Selection, Rank-based Selection, Tournament Selection; Crossover Techniques: Single-point Crossover, Two-point Crossover, Uniform Crossover, Partially Mapped Crossover, and Order Crossover; Mutation Operators; Replacement Strategies: Generational GA, Steady GA, Elitist GA	4
4.	Hybrid Evolutionary Algorithms, Multi-objective Optimization Evolutionary Algorithms	Hybrid EA: Need of Hybridization, Memetic Algorithm, Intelligent Initialization, Local Search, Lamarkian vs. Baldwinian adaptation. Multi-objective Optimization EA: Dominance, Non-dominated Solution, Pareto Optimal Solution, Elitist Non-dominated Sorting Algorithm.	3
5.	Neuro-Computing	Introduction to Artificial Neural Network (ANN): Artificial vs Biological neuron, Basic terminology; Classification and Inductive Learning; Linear seperability; Basic models of ANN; McCulloch-Pitts Neuron; Perceptron: Architecture, Perceptron learning rule, and Delta learning rule.	3
6.	Artificial Neural Network Models	Supervised Learning Network: Multi-layer Feed Forward Network, Back-propagation algorithm; Associate Memory Networks: Introduction and training algorithm for pattern association, Hopfield Network, Unsupervised Learning Network: Competitive Learning, Kohonen Self- Organizing Feature Maps.	6
7.	Swarm Intelligence	Introduction to Swarm Intelligence, Particle Swarm Optimization (PSO): Algorithm, PSO vs EAs; Ant Colony Optimization (ACO): ACO Procedure, Travelling Salesman Problem using ACo, Ant Systems and its direct Variants (Elitist Ant Systems, Rank-based Ant Systems, Max-Min AS, Ant Colony	7

		Systems);	
8	Nature Inspired Algorithms	Artificial Bee Colony; Grey Wolf Optimization; Cuckoo Search	6
9.	Artificial Immune System	Immune System and Immunity; Artificial Immune System(AIS); Biological Immune System(BIS) vsArtificial Immune System(AIS); Typical Applications of AIS; General framework for AIS: Problem Representation, Affinity measure, Selection, Mutation; Basic Artificial Immune Models and Algorithms: Negative Selection Algorithms, Clonal Selection Algorithm, Immune Network Models; Movie Recommender System using AIS.	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (15 marks Project, 5 marks Attendance, 5 Marks Tutorial Assignment)
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.	Xin-She Yang. *Nature-inspired optimization algorithms*. Elsevier, 2014.
2.	Raymond Chiong ed. *Nature-inspired algorithms for optimisation*. Vol. 193. Springer, 2009.
3.	Dario Floreano and Mattiussi Claudio. *Bio-inspired artificial intelligence: theories, methods, and technologies*. MIT press, 2008.
4.	De Castro, Leandro Nunes. *Fundamentals of natural computing: basic concepts, algorithms, and*

	applications. Chapman and Hall/CRC, 2006.
5.	Swarm and Evolutionary Computation: Elsevier

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12HS412	**Semester Odd**	**Semester VII Session** 2018 -2019 Month from July 2018 - December 2018
Course Name	HUMAN RESOURCE ANALYTICS		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr Kanupriya Misra Bakhru
	Teacher(s) (Alphabetically)	Dr Kanupriya Misra Bakhru

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-20.1	Understand different analytical techniques used for solving HR related problems**.**	Understand Level (C 2)
C401-20.2	Apply descriptive and predictive analysis techniques to understand trends and indicators in human resource data.	Applying Level (C 3)
C401-20.3	Analyze key issues related to human resource management using analytical techniques.	Analyze Level (C 4)
C401-20.4	Critically asses and evaluate the outputs obtained from analytical tools and recommend HR related decisions.	Evaluate Level (C 5)
C401-20.5	Create hypotheses, propose solutions and validate using appropriate analytical tehcniques	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Human Resource (HR) Analytics	Understanding the need for mastering and utilizing HR analytic techniques, Human capital data storage and 'big (HR) data' manipulation, Predictors, prediction and predictive modeling, Current state of HR analytic professional and academic training, HR's Contribution to Business Value, the Changing Nature of HR.	8
2.	Human Resource information systems and data	Understanding HR metrics and data, Data collection, tracking, entry, Data availability in the entire Employment Lifecycle, Approaches and costs of collecting HR related data, Analysis software options, Using SPSS, Preparing the	8

		data.	
3.	Analysis Strategies	From descriptive reports to predictive analytics, Statistical significance, Data integrity, Types of data, Categorical variable types, Continuous variable types, Using group/team-level or individual-level data, Dependent variables and independent variables, Introduction of tools for HR data analysis: Correlation, Regression, Factor Analysis, Cluster Analysis, Structural equation modeling.	10
4.	Application of Human Resource Analytics	Workforce Planning Analytics, Diversity Analytics, Talent Sourcing Analytics, Talent Acquisition Analytics, Talent Engagement Analytics, Training and Intervention Analytics, Analytical Performance Management, Retention Analytics.	10
5.	Future of Human Resource Analytics	Rise of Employee Behavioral Data, Automated Big Data Analytics, Big Data Empowering Employee Development, Quantification of HR, Artificial Intelligence in HR.	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Quiz)
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.	Bhattacharyya, HR Analytics: Understanding Theories and Applications, Sage, 2017
2.	Pease, Byerly and Jac Fitz-enz, Human Capital Analytics: How to Harness the Potential of Your Organization's Greatest Asset, Wiley, 2012
3.	Isson, Harriott and Jac Fitz-enz, People Analytics in the Era of Big Data: Changing the Way You Attract, Acquire, Develop, and Retain Talent, Wiley, 2016
4.	Guenole, Ferrar and Feinzig, The Power of People: How Successful Organizations Use Workforce Analytics To Improve Business Performance, First Edition, Pearson, 2017
5.	Sesil, Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing, Incentive and Improving Collaboration, Pearson, 2014

Detailed Syllabus

Lecture-wise Breakup

Course Code	17B1NHS731	**Semester: Odd**	**Semester** VII **Session** 2018 -2019 Month from **July 2018 to Dec 2018**
Course Name	Customer Relationship Management		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-17.1	Apply the financial, social and electronic aspects of the Customer Relationship in business situations.	Apply Level (C3)
C401-17.2	Appraise the role of customer share and customer centricity in organizations.	Apply Level (C3)
C401-17.3	Develop the skills to understand customization, innovation and co-creation in organizations and apply them in business contexts.	Analyze Level (C4)
C401-17.4	Analyze the role of interactive technology for customer engagement, customer retention and customer experience management in organizations.	Analyze Level (C4)
C401-17.5	Evaluate the technological solutions and their applications for effective Customer Relationship Management across different functions in organizations.	Evaluate Level (C5)
C401-17.6	Develop specific models for response modelling and consumer profiling in organizations.	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for**

			the module
1.	CRM-The Strategic Imperatives	Introduction, CRM in Marketing and IT, CRM for Business Leadership, Criticality of customer relationships, Why businesses should adopt CRM, Implementing CRM.	3
2.	Conceptual Foundations of CRM, Building Customer Relationships	Evolution of CRM, Benefits, Schools of thought on CRM, Defining CRM. Customer Retention and Customer Acquisition, Customer Profitability is Skewed, Service Benefits of CRM, Transaction Marketing vs. Relationship Marketing, Relationship Building as a process, Bonding for Customer Relationships-Financial, Social, customization and Structural bonds, Ladder of Loyalty Zero Customer Defection, CRM Framework.	7
3.	Relationship Marketing and Economics of CRM	Internal and external relationships, Electronic Relationships, Operational, Analytical and Collaborative CRM, Market Share vs. Share of Customer, Customer Lifetime Value, and Activity based costing for CRM	6
4.	CRM in B2C ,B2B Markets , Customer Experience Management	CRM in Product and Service Markets, Case Studies, Characteristics of Business Markets, Participants in the business buying process, Key Account Management, Using KAM for Customer Segmentation, Customer Retention Strategy, KAM as a growth and Development Strategy, Customer Value Management in Business Markets, Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation.	7
6.	Components of e CRM solutions (Overview) and Role of Digital Technologies	Data warehousing, Datamining and CRM, Market Basket Analysis and Retail sector, Campaign Management, Sales Force Automation, Customer Service and Support, Corporate Blogs, Online communities, Twitter, Wikis. The Experience ecosystem. CEM, Consumer engagement, segmentation and differentiation.	7
7.	Product offerings in the CRM Marketplace(Overview) and CRM Roadmap	Evaluating Technological solutions for CRM, Comparison of Siebel, Oracle, MySAP.com and People Soft Enterprise solutions, Comparison of Talisma, Sales logix, Microsoft and Sales notes for small and medium enterprises, Defining a CRM strategy, CRM Implementation Roadmap, Developing a relationship orientation, Customer centric marketing and processes, Building organizational capabilities through internal marketing, Issues in implementing a technology solution for CRM.	7
8.	Operational issues	Process view of CRM, Budgeting for attraction vs.	5

	in implementing CRM,Social CRM	retention, Learning from customer defections, Customer Retention Plans, Evaluating Retention programs, Social Customer Relationship Management, Social Customer Insights, Social CRM Strategy, and Social Customer Analytics.	
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project: Report and Viva)
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.	Customer Relationship Management-A strategic perspective, G. Shainesh, Jagdish Sheth, Reprinted Macmillan Publishers India Limited, 2009.
2.	Mukerjee, K., Customer Relationship Management-A Strategic approach to Marketing,Third Edition Prentice Hall of India, 2007.
3.	Customer Relationship Management Concepts and Technologies-Francis Buttle ,Third Edition Taylor and Francis,2015.
4.	Berry, Michael, J. A, Linoff, Gordon S., Datamining Techniques for Sales, Marketing and CRM, Second Edition, Wiley Publications, 2007.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NHS831	**Semester**: Odd	**Semester**: VII **Session** 2018 -2019 Month **from July 2018-Dec 2018**
Course Name	Gender Studies		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Ms Puneet Pannu
	Teacher(s) (Alphabetically)	Ms Puneet Pannu

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C 401-19.1	Demonstrate knowledge of the construct of gender and the way it intersects with other social and cultural identities of race, class, ethnicity and sexuality	Understand(C2)
C 401-19.2	Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity and masculinity	Apply (C3)
C 401-19.3	Analyze the ways in which societal institutions and power structures such as the family, workplace impact the material and social reality of women's lives	Analyze (C4)
C 401-19.4	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporary settings	Evaluate (C5)
C 401-19.5	Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies	Evaluate (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	**Introducing Gender Issues**	• Sex and Gender • Types of Gender • Gender Roles and Gender Division of Labor • Gender Stereotyping and Gender Discrimination • The Other and Objectification	8
2.	**Gender Perspectives of**	• Biological, Phenomenological and Socio-Cultural Perspectives of body	8

	Body & Language	• Body as a Site and Articulation of Power Relations • Cultural Meaning of Female Body and Women's Lived Experiences • The Other and Objectification	
3.	**Social Construction of Femininity** & **Feminism**	• Bio-Social Perspective of Gender • Gender as Attributional Fact • Feminine & Feminist • Major Theorists of Feminism Challenging Cultural Notions of Femininity • Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism & Cyber feminism • Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ;Cultural Feminism & Celebrating Womanhood • Analysis of role women have played across cultures	9
4.	**Social Construction of Masculinity**	• Definition and Understanding of Masculinities • Sociology of Masculinity& its Types • Social Organization of Masculinity and Privileged Position of Masculinity • Politics of Masculinity and Power • Major Theorists of Masculinity • Masculine Identities in Literature, Cinema & Media.	9
5.	**Gender Sensitization** **Empowerment &Gender Inclusivity**	• Women , Law & Women Rights In India • From Women's Studies to Gender Studies: A Paradigm Shift • Gender Studies & Media: Creating New Paradigms in Gender & Culture	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Poster Presentation, 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	**Davis K., et al**, "*Handbook of Gender and Women's Studies*. London: Sage. (2006)
2	**Helgeson, Vicki S**., "*The Psychology of Gender",* Pearson(2012)
3	**Friedan B.,** "*The Feminine Mystique"*, Penguin. (1971/1992)
4	**Debeauvoir S**. , "*The Second Sex"*, Vintage (1953/1997)

5	**Wharton Amy S.,** "*The Sociology of Gender: An Introduction to Theory & Research*", Wiley-Blackwell (2005)
6	**Pachauri G**.," *Gender, School & Society*", R.Lall Publishers(2013)
7	**Connell R.W**, "*Masculinities*", Cambridge: Polity. (1985)
8	**MacInnes J**., "The *End of Masculinity"*. Buckingham: Open University Press. (1998)
9	**Kaul A.& Singh M**., *"New Paradigms for Gender Inclusivity*", PHI Pvt Ltd (2012)

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17B1NHS732**	**Semester :** Even	**Semester** VII **Session** 2018 -2019 **Month from** July 2018 to Dec 2018
Course Name	Indian Financial System		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Mukta Mani(Sec62), Dr. Sakshi Varshney(Sec128)	
	Teacher(s) (Alphabetically)	Dr. Mukta Mani(Sec62), Dr. Sakshi Varshney(Sec128)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C401-1.1	Understand the inter-linkage of components of financial system and financial instruments of Money market and Capital market.	Understanding Level (C2)
C401-1.2	Analyze ways of fund raising in domestic and international markets	Analyzing Level (C4)
C401-1.3	Understand functioning of Stock market and evaluate securities for investment.	Evaluating Level (C5)
C401-1.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	Applying Level (C3)
C401-1.5	Apply knowledge of Income tax for calculation of tax liability of individual.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Meaning, Importance, and functions of Financial system. Informal and Formal financial system, Financial markets, Financial Institutions, Financial services and Financial instrument	4
2.	Money Market	Features of money market Instruments: Treasury bills, commercial bills, commercial papers, certificates of deposit, call and notice money, Functions of money market, Linking of money market with Monetary policy in India	5

3.	Capital Market	Features of Capital market instrument: Equity shares, Bonds. Fund raising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO-Intermediaries in IPO, Book building process and allotment of shares	6
4.	Foreign investments in India	Fund raising from foreign market through: Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	5
5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualisation, broker, listing of securities, dematerialisation, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	5
7.	Stock Valuation and Analysis	Investing basics: Consideration of Risk and Return, Stock Valuation and Analysis- Fundamental analysis: Economy, industry and company analysis; Technical Analysis of stocks using technical charts	6
8.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	4
9.	Overview of Income Tax	Basics of Income tax- Concept of previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- basic, DA, HRA, leave salary pension and other allowances; Income from House Property- self occupied house, rented house; Income from Capital Gain, Deductions under section 80C to 80U.	7
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, class test)
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.	Pathak Bharti V, *Indian Financial System,* 3rd Ed.,Pearson Education, 2013
2.	Madura Jeff, *Personal Finance*, 5th Ed, Pearson Education, 2013.
3.	Machiraju H R, *Indian Financial System*, 4th Ed, Vikas Publication, 2010
4.	Bhole L M, *Financial Institutions and Markets*, 4th ed. Tata McGraw Hill Publication, 2006.
5.	Singhania & Singhania, Students Guide to Income Tax, Taxmann Publication, 2013.

Detailed Syllabus

Lecture-wise Breakup

Course Code	17B1NMA731	**Semester Odd** **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 **Month from** July 2018-Dec. 2018
Course Name	Applied Linear Algebra		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**	Dr. R. C. Mittal	
	Teacher(s) (Alphabetically)	Dr. R. C. Mittal	

COURSE OUTCOMES : After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C401-7.1	explain field, vectors, vector spaces and their dimensions.	Understanding level (C2)
C401-7.2	apply linear transformations in solving practical engineering problems.	Applying Level (C3)
C401-7.3	develop the concept of rank, determinant, existence and uniqueness of solution of a system of linear equations.	Applying Level (C3)
C401-7.4	explain the concept of length, distance and inner-product.	Understanding level (C2)
C401-7.5	apply the concept of orthogonality and orthogonal matrices to orthogonalize a set of linearly independent vectors.	Applying Level (C3)
C401-7.5	analyze eigenvalues, eigenvectors and their properties to solve a system of ordinary differential equations.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Vector Space and Dimension	Field, Vector Space, Vector subspace, linear dependence and independence, Span of a set, Dimension of a vector space, Direct Sum and Complement	7
2.	Linear Transformation I	Linear Transformation and its algebra, and its matrix representation, homomorphism, isomorphism, rank and null subspace, rank-nullity theorem, Solution of a system of Linear Equations, Determinant	7

3.	Linear Transformation II	Change of basis, Inverse of a linear transformation, Linear functional, transpose	5
4.	Inner Product and Metric	Inner product space, Metric and normed spaces. Orthonormal basis, Orthogonal Subspaces, Gram-Schmidt orthogonalization.	8
5.	Eigen Values and Eigen Vectors	Eigen values and Eigenvectors, Modal matrix and diagonalization, Similarity Transformation, Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices	9
6.	Applications of Linear Algebra	Bilinear and Quadratic forms, Positive definite matrices, Norm of a matrix, Condition number,Application to find solutions of ordinary differential equations	6
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Quizzes)
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.	**Hoffman, K and Kunze, R.** , Linear Algebra, Fourth Edition, Prentice Hall of India, 2005
2.	**Strang, G**., Linear Algebra and its Applications, 3rd Ed., 1998
3.	**Noble, B. and Daniel, J.** , Applied Linear Algebra, Prentice Hall of India, 2000
4.	**Lipshutz, S. and Lipsom, M. ,** Linear Algebra, 3rd Edition, Schaum Series, 2001
5.	**Krishnamurthy, V., Mainra, V. P., and Arora, J. L.** , An Introduction to Linear Algebra, Affilated East-West, 1976

Detailed Syllabus

Lecture-wise Breakup

Course Code	16 B19EC691	**Semester Even (specify Odd/Even)**	**Semester** 7th **Session** 2018 -2019 Month from Jan to June
Course Name	Renewable Energy		
Credits	2	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Vinay A. Tikkiwal
	Teacher(s) (Alphabetically)	Mandeep Narula, Vinay A. Tikkiwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain the need of renewable sources of energy, impact of renewable energy on environment, challenges in the electric grid, Smart Grid.	Understanding (Level II)
CO2	Analyze basics of Solar radiation and Solar photovoltaics, Balance of PV systems	Analysis (Level IV)
CO3	Analyze wind energy resource and designing of Wind Energy Generators	Analysis (Level IV)
CO4	Illustrate different biomass energy resources, and extraction of biomass energy	Understanding (Level II)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction**	Overview of energy use and related issues, major energy options, issues of supply and demand, energy conversions, global climate change issues, effects on ecology and biodiversity, status of renewable energy in India.	4
2.	**Solar Energy**	Fundamentals of Solar radiation, Solar Resource Assessment, Solar Photovoltaics, Balance of PV Systems, and Solar Thermal.	10

3.	**Wind Energy**	Wind resource, Basics of aerodynamics, Maximum power extraction from wind resource fundamental power equations, Basic design concepts of Wind Energy Generators	8
4.	**Biomass Energy**	Biomass resource, extracting biomass energy, landfill gas, waste to energy, energy balances and economics.	6
5.	**Electric Grid**	Basic operations, performance related issues, new developments and challenges in the electric grid.	2
		Total number of Lectures	**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid-Term	30
End Semester Examination	40
TA	30
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.	Solanki, C.S., *Solar Photovoltaics: Fundamental, technologies and applications,* 3rd ed., Delhi: Prentice Hall of India, 2015
2.	Momoh, J., *Smart Grid: Fundamentals of Design and Analysis*, Wiley-IEEE Press, 2012.
3.	Ahmed S., *Wind Energy: Theory and Practice*, 3rd ed., Delhi: Prentice Hall of India, 2016
4.	Earnest J., *Wind Power Technology*, 2nd ed., Delhi: Prentice Hall of India, 2015
5.	Kothari, D.P., Singal, K.C. and Ranjan, R., *Renewable Energy Sources and Emerging Technologies*, 2nd ed., Delhi: Prentice Hall of India, 2016.

Lecture-wise Breakup

Course Code	17B1NBT733	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 Month from **July-December**
Course Name	Stress: Biology, Behaviour and Management		
Credits	3 (3-0-0)	**Contact Hours**	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-16.1	Explain the biological basis of stress.	**Understand Level (C2)**
C401-16.2	Relate cognitive processes and stress management.	**Understand level (C2)**
C401-16.3	Apply acquired knowledge in understanding and adjusting to different people and situations.	**Apply level (C3)**
C401-16.4	Improve quality of life by reducing stress.	**Create level (C6)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	The concept of Stress - Major stressors vs. routine hassles ; Major types of Stressors - Occupational Stressors; Organization Stress; Environmental Stressors	2
2.	Scientific Foundations of Stress	The Nature of Stress; Human Physiology; Stress and Relaxation Responses; Stress and Disease	4
3.	**Body Systems activated by stressors**	Nervous System, Endocrine System, immune system, Cardiovascular system, Gastrointestinal System, Muscles	7
4.	Cognitive Psychology	Theoretical models: psychodynamic, behavioral, and cognitive; Thoughts, Beliefs and Emotions: Behavioral Patterns; Self-concept and Self-esteem; Stress emotions - Anger and Fear; Personality Traits – Stress prone and Stress resistant	9
5.	Social Psychology	Family and Culture; Demands and Responsibilities; Relationships; Verbal and Non-verbal Communication;	2

		Human Spirituality	
6.	Stress and the Human Environmental Interactions:	Time; Body Rhythms; Weather and Climate; Nutrition; Exercise; Drugs and Addictions; Violence and Post Traumatic Stress	2
7.	Stress management techniques and therapeutic strategies	Psychological interventions; Developing Cognitive Coping Skills; DIY Strategies- Exercise and Health; Journal Writing; Music and Art Therapy; Humor and Comic Relief; Creative Problem Solving; Meditation; Mindfulness – Eastern & Western approaches	12
8.	The adaptive brain	Neuroplasticity – positive adaptation to stress	2
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Quiz and class discussions)
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.	George Fink "Stress: Concepts, Cognition, Emotion, and Behavior: Handbook in Stress Series; Volume 1; Academic Press; 2016
2.	Jeanne Ricks "The Biology of Beating Stress"Kindle Edition; 2014
3.	Jerrold S. Greenberg "Comprehensive Stress Management" Tata McGraw-Hill Edition; Tenth Ed., 2009
4.	Brian Luke Seaward "Managing Stress: Principles and Strategies for Health and Well-Being" Sixth Ed., Jones and Bartlett Publishers, 2009
5.	Saundra E. Ciccarelli, and Glenn E. Meyer "Psychology" South Asian Edition; Published by Pearson Education (2008); ISBN 10:8131713873 / ISBN 13: 9788131713877

Detailed Syllabus

Lecture-wise Breakup

Course Code	10B1NPH732	**Semester :** Odd	**Semester:** VII **Session:** 2018 -2019 Month: **from July to December**
Course Name	Nanoscience and Technology		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Navendu Goswami and Dr. Sandeep Chhoker
	Teacher(s) (Alphabetically)	Dr. Navendu Goswami and Dr. Sandeep Chhoker

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-4.1	Define the Nanoscience and Technology and to know about various other terminologies and developments involved with Nanoscience and Technology	Remembering (C1)
C401-4.2	Classify the nanomaterials depending on the nature of dimensionalities, type of materials classes and explain the basic concepts of nanomaterials	Understanding (C2)
C401-4.3	Apply the concepts of Nanoscience for solving the theoretical and numerical problems	Applying (C3)
C401-4.4	Determine the properties of nanomaterials through suitable characterization tools	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Development of nanoscience and nanotechnology, naturally occurring nanomaterials, Crystallinity of nanomaterials, Metallic nanostructures, Semiconductor nanostructures Magnetic nanomaterials, Chemically assisted nanostructures, Growth in 2-D nanostructures, Carbon nanomaterials	10
2.	Properties of Nanomaterials	Surface to volume ratio, Surface states and energy, Nanoscale oscillators, Confinement in nanostructures, Density of States and number of states of 0-, 1-, 2-, 3-dimensional systems, Change in Band structure and gap, Energy levels, confinement energy and emission in nano, Fluorescence by QDs, Concept of Single electron transistor	5
3.	Nanomaterials Synthesis	Introduction to synthesis techniques, Top down and bottom up approach, Biological methods, Sol-gel method, Nucleation and growth, Ball Milling technique, Chemical vapor deposition, Physical Vapor deposition: Concept of	10

		Epitaxy and sputtering, Basics of Photolithography and its limitations, Soft Lithography and Nanolithography	
4.	Characterization of Nanomaterials	Resolving power (Rayleigh and other criteria) of microscopes and their limitations for nanostructure measurements, Concept of Far and Near field and modification by NSOM, Basic principle, Design of setup, Theory and working, Characterization procedure, result analysis, Merits/demerits of SEM, TEM, STM, AFM	5
5.	Application of Nanomaterials	Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High T_c nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS	10
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
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.	*Nanostructures and nanomaterials: synthesis properties and application*, Guozhong Cao, Imperial college press, London.
2.	*Introduction to nanotechnology,* Charles Poole *et al* J John Wiley & Sons, Singapore.
3.	*The Handbook of Nanotechnology: Nanometer Structures, Theory, Modeling, and Simulation*, A. Lakhtakia, Spie Press USA.
4.	*Springer Handbook of Nanotechnology,* Edited by B. Bhushan, Springer Verlag.