Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12CS436	**Semester** ODD **(specify Odd/Even)**	**Semester** VII **Session** 2019-2020 **Month from** July 2019- December 2019
Course Name	Software Construction		
Credits	3-1-0	**Contact Hours**	4

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

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	9
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	6
4.	Code Improvements	Debugging, Code Refactoring, Code Optimization and Tunning strategies and techniques	8
5.	Code Analysis	Tracing, Static and Dynamic analysis, identifying bad smells in code	4
6.	Generic Programming and Scaling Code	Parameterization and Generics, Internationalization of code, Securing Code	10
7.	Concurrency , synchronization and serialization in code	Implementing concurrency and serialization in code	6
		Total number of Lectures	**46**

Evaluation Criteria

Components	**Maximum Marks**

T1	20
T2	20
End Semester Examination	35
TA(Tutorials regularity & Marco Assignments)	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
Lecture-wise Breakup

Course Code	**18B12HS412**	**Semester Odd**	**Semester VII Session 2019 -2020** **Month from July 2019 - December 2019**
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 techniques	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 data.	8
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	10

		Analytics, Analytical Performance Management, Retention Analytics.	
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

Course Description

Subject Code	19B12CS422	**Semester** Odd	**Semester VII Session** 2019-20 **Month from** July '19 **to** Dec '19
Subject Name	Mathematical Foundations for Intelligent systems		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr.Dhanalekshmi G
	Teacher(s)	Dr. Archana Purwar, Dr.Dhanalekshmi G
Sections	1	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-5.1	Explain the concepts of computing eigenvectors, vector spaces , manipulate linear transformation and various decomposition techniques, probability, entropy .	Understanding Level (C2)
C431-5.2	Explain concepts of unconstrained , constrained optimization ,convexity, blackbox & global Optimization , langrange's function .and its application such as Support Vector Machine etc.:	Understanding Level (C2)
C431-5.3	Explain concepts of time series analysis, linear vector calculus, Multivariable Calculus, Multivariate Chain Rule Gradient Descent Methods	Understanding Level (C2)
C431-5.4	Apply the concepts of linear algebra, probability, Fourier transformation, optimization techniques, concepts of calculus in study of intelligent systems	Apply Level (C3)
C431-5.5	Analyze different approaches for constructing intelligent systems using concepts of linear algebra, probability, Fourier transformation, optimization techniques, concepts of calculus in study intelligent systems	Analyze Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Application of Linear	Introduction to linear algebra ; Data	7

	Algebra in intelligent systems	preparation using Linear Algebra in tabular and image datasets such as one hot encoding and dimensionality reduction , use of linear algebra notation and methods in sub-fields such as recommender systems.	
2.	Application of Probability and Information in intelligent systems	Introduction to Probability and entropy and its applications such as static and dynamic Bayesian network, Markov chain network	6
3.	Optimization in intelligent systems	Unconstrained , constrained optimization ,convexity, Blackbox & Global Optimization Langrange's function and its application such as Support Vector Machine etc.:	12
4.	Application of Fourier Transformation in data analytics	Introduction, time series analysis, application of Fourier transform in data processing and analysis	7
5.	Application of multivariate calculus	Introduction to multivariate Calculus, use of calculus in intelligent applications such as multivariate hyperbolic tangent neural network approximation, multivariate sigmoidal neural network approximation , deep learning NN	10
		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: (APA format)	
1.	***Learning with Kernels*** by Scholkopf and Smola (2000)
2.	Lecture Notes on The Fourier Transform and its Applications by Prof. Brad Osgood Electrical Engineering Department Stanford University
3.	Optimization for Machine Learning

	Suvrit Sra, Sebastian Nowozin and Stephen J. Wright
4.	Multivariable Calculus with Applications Maria Shea Terrell and Peter Lax
5.	Duda, Hart, Stork: *Pattern Classification*.
6.	Strang, Gilbert. *Introduction to Linear Algebra*. 4th ed. Wellesley-Cambridge Press, 2009. ISBN
7.	**Bishop, C. M.: *Pattern Recognition and Machine Learning*.**
8.	Lecture Notes on Maths for Intelligent Systems **Marc Toussaint**
9.	***Principle and Theory for Data Mining and Machine Learning*** by Clark, Forkoue, Zhang (2009)

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12CS423	**Semester ODD**	**Semester** VII **Session** 2019 -2020 **Month from Jul-Dec**
Course Name	Computing for Data Science		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. Megha Rathi
	Teacher(s) (Alphabetically)	Dr. Megha Rathi, Dr. Mohit Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-7.1	Make use of basic concepts ,methods, and mathematics relevant to computational techniques for data science	Apply [Level 3]
C431-7.2	Develop own statistical analyses and implement them with advanced statistical programming tools	Apply [Level 3]
C431-7.3	Develop and apply advanced and associated computing techniques and technologies.	Apply [Level 3]
C431-7.4	Compare the performance of multiple methods and models, recognize the connections between how the data were collected and the scope of conclusions from the resulting analysis, and articulate the limitations and abuses of formal inference and modeling.	Analyze [Level 4]
C431-7.5	Evaluate strategies for constructing models and can use different measures of model fit and performance to assess models.	Evaluate [Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Data Science	Characteristics & Evolution of data, Data Science Process, Types & Levels of data, Datafication, Steps of Data Science, Central Tendency, Measure of Dispersion, Data Munging, Feature Engineering	7
2.	Statistical Methods in Data Science	Data Distribution (Bernoulli, Uniform, Binomial, Normal, Poisson, Exponential), Mathematical Statistics, Inferential Statistics, Descriptive Statistics, Random Variable, Probabilistic Statistics, Sampling of data, Correlation Analysis	6
3.	Technologies & Tools in Database Analytics	SQL Essentials for data science, String Pattern, Ranges, Sorting & Grouping Result Set, working with multiple tables, Accessing database using R/Python, Database Text Analysis, User defined Functions & Aggregates, MADlib, Tools & Techniques for unstructured data.	7
4.	Computing techniques for Data Science	Regression, Mapping Problem to Machine Learning Task, Memorization Method, Generalized Additive Models, Time-Series Model, Predictive Modeling, Ensemble Techniques, Outlier Detection, Recommendation Engine	12

5.	Statistical Methods for Evaluation	Hypothesis Testing, Difference of Means, Significance Level and P-Value, Test Statistics (Z-test, ANOVA,T-Test, Redundancy Test), Bias Variance Trade off, Cross Validation	4
6.	Exploratory Data 0 Analysis & Data Science Process	Visualization before analysis, Dirty Data, Visualizing single and multiple variables, summary statistics of EDA, Data Exploration versus Presentation, Real time case study, Tools & Techniques	4
7.	Data Science & Ethical Issues	Privacy, Security & Ethics, Next generation Data Scientist	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (**Attendance and Tut Performance , Quiz/ Mini-Project/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.	Haider, M. (2015). Getting Started with Data Science: Making Sense of Data with Analytics. IBM Press.
2.	Dietrich, D. (Ed.). (2015). Data science & big data analytics: discovering, analyzing, visualizing and presenting data. Wiley.
3.	Trevor, H., Robert, T., & JH, F. (2009). The elements of statistical learning: data mining, inference, and prediction.
4.	Grus, J. (2015). Data science from scratch: First principles with Python. " O'Reilly Media, Inc.".
5.	Taylor, J. K., & Cihon, C. (2004). Statistical techniques for data analysis. Chapman and Hall/CRC.
6.	Shalev-Shwartz, S., & Ben-David, S. (2014). Understanding machine learning: From theory to algorithms. Cambridge university press.
7.	Zumel, N., & Mount, J. (2014). Practical data science with R. Manning Publications Co..
8.	Saltz, J. S., & Stanton, J. M. (2017). An introduction to data science. SAGE Publications.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12CS424	**Semester** ODD **(specify Odd/Even)**	**Semester** 7th **Session** 2019 -2020 **Month from** July-Dec 2019
Course Name	Industrial Automation using Internet of Things		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Hema N
	Teacher(s) (Alphabetically)	Dr. Hema N

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-1.1	Development of smart sensors and actuators for smart industry	Apply Level (C3)
C432-1.2	Develop industrial control application using Embedded C and ARM Cortex Microcontrollers	Create Level (C6)
C432-1.3	Apply new ways of servicing customers and the creation of new revenue models	Apply Level (C3)
C432-1.4	Analyze desired goal of industrial transformation	Analyze Level (C4)
C432-1.5	Design and development of IIoT Application for Industry 4.0 Architecture	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Fundamentals of IIoT & Wireless Sensor Networks	Introduction to different Sensors and actuators meant for Industrial IoT, different types of communication use in IIoT	5
2.	IIoT Architecture and Industry 4.0 Architecture	IIoT architecture, Fundamental Architectural and Software Architecture Practice, Three-tier system architecture . Industry 4.0 and RAMI 4.0, Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories, Next Generation Sensors, Collaborative Platform and Product Lifecycle Management.	5
3.	Embedded C and ARM Cortex Microcontrollers	Basic mother boards related to cortex microcontrollers, sensors configuration, actuator configuration and programming	9
4.	IIoT Technology for Smart Sensors, Robotics & Automation	IIoT Technology for Smart Sensors, Robotics & Automation using case study Automated guided vehicles (AGVs) and Robot automation with LIDAR and camera sensor fusion	8
5.	Augmented/Virtual reality, Big Data Analytics and Cloud Integration	IIoT for Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis	5

6.	Low power Hardware devices	Low power Hardware devices, Upgradation of conventional M2M systems for IIoT,	2
7.	IIoT Application Development	Difference between IIoT and consumer IoT Applications at technical level using case study (i) Food processing industries, (ii) Applications of UAVs in Industries (iii) Smart home appliances	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project + 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.	Architectural Design Principles For Industrial Internet of Things by Hasan Derhamy
2.	"Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress)
3.	"Industrial Internet of Things: Cyber manufacturing Systems" by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)
4.	Industrial IoT Reference Architecture document
5.	Deploying IIoT sensors in the smart factory by Steve Taranovich
6.	Introduction to Industry 4.0 and Industrial Internet of Things by Dr. Sudip Misra

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12CS426	**Semester** ODD **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 **Month from** July '19 to Dec '19
Course Name	IoT Analytics		
Credits	4	**Contact Hours**	3 -1-0

Faculty (Names)	**Coordinator(s)**	Dr. K. Rajalakshmi
	Teacher(s) (Alphabetically)	Dr. K. Rajalakshmi Mr. Vivek Kumar Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-3.1	Understand how analytics relates to IoT data	Understand (Level 2)
C432-3.2	Apply appropriate machine learning, Deep Learning algorithms to gain business insights from IoT data.	Apply (Level 3)
C432-3.3	Analyze various big data platforms and massively parallel processing databases for IoT systems	Analyze (level 4)
C432-3.4	Examine how streaming and predictive analytics can be used for IoT Data processing and analysis, in real time.	Apply (Level 3)
C432-3.5	Understand the concept of network flow analytics using Flexible NetFlow in IoT systems.	Understand (Level 2)
C432-3.6	Evaluate the performance of the overall system and security in IoT network.	Evaluate (level 5)
C432-3.7	Design methods and develop web based IoT applications using big data analytics for real world problems	Create (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	INTRODUCTION TO DATA ANALYTICS FOR IoT	An introduction to Data Analytics for IoT – Structured , Unstructured and Heterogeneous Data – Data in Motion Versus Data at Rest – Featuring Engineering , Validation, Machine learning Models - Predictive Analytics -Anomaly detection, Forecasting	8
2.	GEOSPATIAL ANALYTICS FOR IoT	Geographical Concepts and Spatial Technology – Vector Based methods, Raster based methods- Storing and Processing geospatial data- Deep Learning techniques for IoT	7
3.	BIG DATA PLATFORM FOR IoT ANALYTICS	Big Data Platform for IoT Analytics - Massively parallel processing databases- Azure Data Lake and IoT Hub, ThingWorx, Node RED, Hadoop Ecosystem, Lambda Architecture- NoSQL Databases	8

4.	EDGE COMPUTING & FOG COMPUTING FOR IoT ANALYTICS	Architecture of Edge and Fog Computing - Edge Analytics Core Functions – Distributed Analytics Systems - Fog Computing -Big Data Metadata Management – Data lifecycle - Data analytics at different Fog Layers –Smart-health application	7
5.	IoT NETWORK ANALYTICS	Flexible NetFlow Architecture – FNF components – Flexible NetFlow in Multiservice IoT Networks	6
6.	WEB ENHANCED IoT	Design layers, design complexity- Web Enhanced Building Automation Systems – Smart City Control and Monitoring – Smart Environment Monitoring	6
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment/Quiz(10), Mini Project (10),Attendance(5))
Total	**100**

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

1.	K David Hanes, Gonzalo Salguerio,"IoT Fundamentals" Pearson, 2018.
2.	Andrew Minteer, "Analytics for Internet of Things (IoT)", Packt, 2018
3.	Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.
4.	Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015
5.	"Fog and Edge Computing : Principles and Paradigms" Rajkumar Buyya, Satish Narayana Srirama, Wiley
6.	Internet of Things Journal, IEEE

Course Description

Subject Code	19B12CS427	**Semester**	**Semester VII Session** 2018 - 19 **Month from** July '19 **to** Dec '19
Subject Name	Introduction to DevOps		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prashant Kaushik
	Teacher(s)	1. Prashant kaushik
Sections	1	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-2.1	Students will be able to understand the needs of scaled infrastructure of micro services and devops related process.	Understand Level (Level 2)
C432-2.2	Students will be able to Plan, measure the need of various types of micro services and devops related process.	Apply Level (Level 3)
C432-2.3	Students will be able to Write scripts for the creating and deploying the micro services for the Developed Application for the calculated load and error messages.	Create Level (Level 6)
C432-2.4	Students will be able to write scripts for the measuring and loading the reports Ansible and Python.	Evaluate Level (Level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Why DevOps? What is DevOps? DevOps Market Trends DevOps Engineer Skills DevOps Delivery Pipeline DevOps Ecosystem	8
2.	Git, Maven and CI	Branching and Merging in Git	8

		Git workflows Git cheat sheet What is CI? Why CI is Required? Introduction to Jenkins (With Architecture) Introduction to Maven	
3.	Jenkins	Jenkins Management Adding a slave node to Jenkins Building Delivery Pipeline Pipeline as a Code Implementation of Jenkins in the Projects	8
4.	Chef and Ansible	Introduction to Ansible Ansible Installation Configuring Ansible Roles Write Playbooks Executing adhoc command	8
5.	Contazarization	Revisiting Kubernetes Cluster Architecture Spinning up a Kubernetes Cluster on Ubuntu VMs Exploring your Cluster Understanding YAML Creating a Deployment in Kubernetes using YAML	10
		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.	**Practical DevOps by Joakim Verona , 2017, Packt publishing**
2.	**Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale**

	by Jennifer Davis, Ryn Daniels by Orielly , 2017
3.	**DevOps: A Software Architect’s Perspectiveby Len Bass, Ingo Weber, Liming Zhu, 2018**
4.	**Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation by Jez Humble and David Farley, 2018**
5.	**Ansible: Up and Running, Automating Configuration Management and Deployment the Easy Way by Lorin Hochstein, Rene Moser, 2017**
6.	**Accelerate, The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations by Nicole Forsgren, Jez Humble, Gene Kim, 2019**

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12MA411	**Semester** Odd	**Semester** VII **Session** 2019 -2020 **Month from** July 2019 to Dec 2019
Course Name	Elements of Statistical Learning		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names) **Coordinator(s)** Dr. Himanshu Agarwal

Teacher(s) (Alphabetically) Dr. Himanshu Agarwal

COURSE OUTCOMES **COGNITIVE LEVELS**

After pursuing the above mentioned course, the students will be able to:

C401-22.1	explain different type of learning techniques.	Understaning Level (C2)
C401-22.2	apply and analyze linear regression techniques	Analyzing Level (C4)
C401-22.3	apply and analyze linear classification techniques	Analyzing Level (C4)
C401-22.4	use and analyse sparse kernel machines	Analyzing Level (C4)
C401-22.5	compare learning models.	Analyzing Level (C4)
C401-22.6	apply unsupervised learning techniques.	Applying Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Overview of learning techniques	Example: polynomial curve fitting, supervised learning, unsupervised learning, reinforcement learning	4
2.	Linear Methods for Regression	Linear Regression Models and Least Squares, The Gauss–Markov Theorem, Multiple Regression from Simple Univariate Regression, Multiple Outputs, Subset Selection, Shrinkage Methods, Methods Using Derived Input Directions, Comparison of the Selection and Shrinkage Methods, Multiple Outcome Shrinkage and Selection	7
3.	Linear Methods for Classification	Linear Regression of an Indicator Matrix, Linear Discriminant Analysis, Logistic Regression, Comparison of Logistic Regression and LDA, Separating Hyperplanes	7
4.	Sparse Kernel Machines	Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression	6
5.	Model Assessment and Selection	Bias, Variance and Model Complexity, The Bias–Variance Decomposition, Optimism of the Training Error Rate, Estimates of In-Sample Prediction Error, The Effective Number of Parameters, Bayesian information criterion, Minimum Description Length, Vapnik–Chervonenkis Dimension, Cross-Validation, Bootstrap Methods, Bagging	6
6.	Boosting	Additive Models**,** Boosting Methods, Loss Functions and Robustness, Numerical Optimization via Gradient Boosting	5
7.	Unsupervised Learning	Association Rules, Cluster Analysis, Hierarchical Clustering, Self-Organizing Maps, Spectral Clustering, Archetypal Analysis, Independent Component Analysis, and Exploratory Projection Pursuit, Multidimensional Scaling, Nonlinear Dimension Reduction, and Local Multidimensional Scaling, The	7

		Google Page Rank Algorithm	
Total number of Lectures			**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments)
Total	**100**

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

1. **A. M. Mood, F. A. Graybill, and D. C. Boes,** Introduction to the Theory of Statistics, McGraw Hill, 1974
2. **A. C. Rencher and G. B. Schaalje,** Linear Models in Statistics, 2nd Ed., Wiley, 2007.
3. **T. Hastie, R. Tibshirani and J. Friedman,** The Elements of Statistical Learning, 2nd Ed., Springer 2008
4. **E. Alpaydin,** Introduction to Machine Learning, 2nd Ed., PHI Learning 2012.
5. **C. M . Bishop,** Pattern Recognition and Machine Learning, Springer 2013.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NCI732	**Semester** Odd **(specify Odd/Even)**	**Semester** 7th **Session** 2018 -2019 **Month from July 2019- Dec 2019**
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	Assessing computing system's threats and access control in Operating Systems	Understand (Level-2)
C430-5.2	Explain Software Security Issues, their solutions along with cryptography	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 of users of computing resources	Understand (Level-2)
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 Signature Based and Host vs Network Based	4
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	6
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	7

		Attacks, Bots, Botnets	
9.	Cryptographic Solution	Types of Cryptography , Key Management, Digital Signature	3
		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

Brief Syllabus

Course Code: 17B1NCI747 Course Name: Cloud Computing

Overview of Distributed System Models and Enabling Technologies, Introduction to Cloud Computing, Introduction to Cloud Computing , Issues and Challenges, Cloud Architecture, Cloud Services and Management, Saas, PaaS, IaaS, Virtualization Technologies, Virtual Machines and Virtualization of resources. Traditional computing architecture & cloud computing architecture, Energy Aware computations, Resource Allocation and Load balancing in Cloud, Cloud Security, Cloud and IoT integration.

	Course Outcome	Cognitive Level
C430-8.1	Understand various Cloud Service Models and Virtualization Technology to Create Virtual Machines for cloud based applications using Virtual Machine Monitors (VMMs).	Understanding (Level 2)
C430-8.2	Analyze various VM migration techniques and their performances in cloud environments.	Analyze Level (Level 4)
C430-8.3	Analyze the performances of VMs for application specific cloud environments.	Analyze Level (Level 4)
C430-8.4	Analyze and evaluate the performance of various energy aware computational techniques used in Cloud environments.	Evaluate (Level 5)
C430-8.5	Develop sustainable systems using cloud based methods and techniques.	Apply Level (Level 3)

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17B1NCI747	**Semester (ODD)**	**Semester** Odd **Session** 2019 - 20 **Month from** July to Dec
Subject Name	Cloud Computing		
Credits	**4**	**Contact Hours**	**3 Lectures+ 1 Tutorial**

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

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Overview of Distributed Computing	Trends of computing, Distributed Computing, Grid Computing, Ubiquitous computing Introduction to distributed computing.	1
		System models for Distributed, Client Server Models, Peer to Peer Models	1

		Next big thing: cloud computing, Cloud Computing, Pay-as-per-use Model, Enabling Technologies.	1
2.	Introduction to Cloud Computing , Issues and Challenges	What's cloud computing, History of cloud computing, Correlation between distributed and Cloud Computing.	1
		Characteristics, Transparency, Scalability, Multi-Tenant architecture, Benefits of cloud computing, Optimal System Resource utilization	1
		Service models, Private, Public, Community, Hybrid, Deployment models. SaaS, PaaS, IaaS.	1
		Current issues and challenges of cloud computing, Management of Data Centers, Energy aware Issue etc.	1
3.	Cloud Architecture	Traditional computing architecture, Layers of traditional architecture, their pros and cons.	1
		Cloud Computing Architecture, Role of Virtualization, Various Models	2
		Role of network in cloud computing, Providing High speed communication bandwidth	1
4.	Virtualization Techniques	Role of Virtualization in Cloud Computing, Virtualization of resources and related issues.	1.5
		Virtualization Technologies, Virtual Machine Monitors, Virtual Machines	1.5
		Virtualization Techniques, ISA Level virtualization, Hardware Abstraction level, OS level, Library Level, Application Level virtualization techniques.	2
		Introduction to Intel Virtualization Technology (IVT)	1
		Intel IA-32 and Itanium Architectures, Challenges in the design of these architectures.	2
		Addressing the challenges by VTx and VTi architectures.	1
		Root Mode and Non-root mode operations of VTx and VTi	1
5.	Energy Aware Computing in Cloud, Resource Allocations and Load Balancing techniques	Energy Aware concepts and techniques.	2
		Energy Aware computations with DVFS,Various	2
		Resource allocation Load balancing techniques.	2
6.	Cloud Simulation platforms and frameworks	Open Source Frameworks CloudSim, GridSim, iFogSim etc.	2
		Creation of Cloudlets VMs, Data Centers in Cloudsim and iFogSim environments	2
7.	Cloud Security	Network level security, Data level security,	1

		Access management and control, Authentication in cloud computing	2
8.	Cloud computing and IoT	Introduction to Cloud and IoT platforms.	1
		Open Source Cloud and IoT integration	2
		Applications of Cloud and IoT for Sustainable developments	2
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.	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
Lecture-wise Breakup

Course Code	17B1NHS731	**Semester: Odd**	**Semester** VII **Session** 2019 -2020 **Month from** July 2019 to Dec 2019
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,	7

		Customer Value Management in Business Markets, Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation.	
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 in implementing CRM,Social CRM	Process view of CRM, Budgeting for attraction vs. 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.	5
Total number of Lectures			**42**
Class Presentations			**6**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation , Class Test 1,Class Test 2, 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.	Customer Relationship Management, Ed. Peelan Rob Beltman, 2nd Edition, Pearson, 2014.
2.	Ou, Y. C., Verhoef, P. C., & Wiesel, T. The effects of customer equity drivers on loyalty across services industries and firms. Journal of the Academy of Marketing Science, *45*(3), 336-356, 2017.
3.	Lin, Y. C., Lee, Y. C., & Lin, S. Y. The influence of the personality traits of webcasters on online games. International Journal of Electronic Customer Relationship Management, *11*(1), 94-103, 2017
4.	Menzel, C. M., & Reiners, T.Customer relationship management system a case study on small-medium-sized companies in north Germany. In *Information Systems for Small and Medium-sized Enterprises* pp. 169-197. Springer, Berlin, Heidelberg, 2014.
5.	Customer Relationship Management-A strategic perspective, G. Shainesh, Jagdish Sheth, Reprinted Macmillan Publishers India Limited, 2009.
6.	Mukerjee, K., Customer Relationship Management-A Strategic approach to Marketing, 3rd

	Edition Prentice Hall of India, 2007.
7.	Customer Relationship Management Concepts and Technologies-Francis Buttle, 3rd Edition Taylor and Francis, 2015.
8.	Berry, Michael, J. A, Linoff, Gordon S., Datamining Techniques for Sales, Marketing and CRM, 2nd Edition, Wiley Publications, 2007.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17B1NHS732**	**Semester :** Odd	**Semester** VII **Session** 2019 -2020 **Month from** July 2019 to Dec 2019
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 Initial Public Offering-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, American Depository Receipts, Global Depository Receipts, External Commercial Borrowings, and Private equity.	5

5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualization, broker, listing of securities, dematerialization, 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- Salary, Allowances, Perquisites, Income from Capital Gain, Deductions under section 80C to 80U.	7
Total number of Lectures			**42**
Class presentations			**6**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation, class tests, 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. Pathak Bharti V, *Indian Financial System,* 5th Edition, Pearson Education, 2018

2. Madura Jeff, *Personal Finance*, 6th Ed, Pearson Education, 2017.

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, 2019.

6. *How to Stimulate the Economy Essay* [Online]Available: https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC

7. Reserve Bank of India, 'Money Kumar & the Monetary Policy', 2007

8. Ashiwini Kumar,Sharma,' De-jargoned: Book building process, Live Mint,2015.

9. Madhavan, N. "Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?", Business Today, 28th June 2009.

10. Kaul, Vivek, "Master Move: How Dhirubhai Ambani turned the tables on the Kolkata bear cartel", The Economic Times, July 1, 2011.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NHS733**	**Semester : ODD**	**Semester: VII Session 2019-20** **Month from July- Dec**
Subject Name	**Human Rights and Social Justice**		
Credits	**3**	**Contact Hours**	**(3-0-0)**

Faculty (Names)	**Coordinator(s)**	**Dr. Chandrima Chaudhuri**
	Teacher	**Dr. Chandrima Chaudhuri**

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C401-18.1	Demonstrate an understanding of the concept and idea of human rights and social justice	Understand (C2)
C401-18.2	Evaluate and interpret information about human rights issues from various sources like print and electronic media, film, documentary and other information technologies	Evaluate(C5)
C401-18.3	Demonstrate an understanding of the International norms and standards of human rights	Understand (C2)
C401-18.4	Analyze the emerging dimensions of human rights and the challenges posed by them	Analyze (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Hours for the module
1.	Conceptual Background of Human Rights and Social Justice	• Meaning and Concept of Human Rights & Social Justice • Notion and Classification of Rights: Natural, Moral and Legal Rights, • Concept of Civil Rights • Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights; Collective/Solidarity Rights), Distinction between CPR & ESCR	6
2.	Evolution of Human Rights	Human Rights in Middle Ages: • Magna Carta Modern Movement for Human Rights: • The United States Declaration of Independence • The French Declaration of the Rights of Man and the Citizen • United States Bill of Rights • Geneva Convention of 1864	9
3.	International Human Rights Standards	• Universal Declaration of Human Rights, 1948. • International Covenant on Civil and Political Rights, 1966 • International Covenant on Economic, Social and Cultural Rights, 1966	8
3.	Human Rights of the specially disadvantaged sections of the society	• Scheduled Castes/Scheduled Tribes and Other Backward Classes: Caste Prejudice and Discrimination • Minorities: Human Rights Issues of Ethnic minorities	8

		• Women and Children: Gender Discrimination, Domestic Violence and Offences against Women; Gender Sensitive Laws, Children: Child Abuse, Child Labour, Street Children • Aged and Disabled Persons: Vulnerability and social taboos	
5.	Human Rights of the Working Class	• Migrant Workers • Bonded Labourers • Agricultural Labourers • Casual Workers	5
6.	Emerging Dimensions Of Human Rights	• National Sovereignty versus 'international enforcement' of human rights • International politics of human rights and selective application of international sanctions • Unilateral use of coercion and implementation of human rights • Human rights, and science and technology	6
Total number of Hours			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (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.	Banton, M. (1996). *International Action against Racial Discrimination*. Oxford: Clarendon Press
2.	Cassese, J. (1990). *Human Rights in Changing World.* Philadelphia: Temple University Press
3.	Cruft, R., Liao, S.M.& Renzo. M. (2015). *Philosophical Foundations of Human Rights*. Oxford: Oxford University Press
4.	Dhiman, O.P. (2011). *Understanding Human Rights An Overview*. New Delhi: Kalpaz Publication
5.	Donnelly, J. (2013).*Universal Human Rights and Practices*. Ithaca: Cornell University Press
6.	Easterly, W. (2014). *The tyranny of experts: Economists, dictators, and the forgotten rights of the poor*. New York: Basic Books
7.	Joshi. K.C. (2019). *International Law and Human Rights*. Lucknow: Eastern Book Company
8.	Saksena, K.P. (ed.) (1984). *Human Rights in Asia: Problems and Perspectives*. New Delhi: HURITER
9.	Sen, A. (1999). *Development as Freedom*. Oxford: Oxford University Press
10.	Sinha, M.K, (2000). *Basic Documents on International Human Rights and Refugee Laws*. New Delhi: Manak Publications
11.	Verma, R.S., (2000). *Human Rights: Burning Issues of the World*. Volumes I, II and III. Delhi: Radiant Publishers
12.	U.N. Department of Public Information. (2018). *Universal Declaration of Human Rights*. U.SA.: United Nations

Lecture-wise Breakup

Course Code	17B1NMA731	**Semester Odd (specify Odd/Even)**	**Semester** VII **Session** 2019 -2020 **Month from** June 2019 toDec. 2019
Course Name	Applied Linear Algebra		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**	Dr. Lokendra Kumar, Dr. Dinesh C. S. Bisht	
	Teacher(s) (Alphabetically)	Dr. Dinesh C. S. Bisht, Dr. Lokendra Kumar	

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)
C401-7.6	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	17B1NMA732	**Semester** - Odd **(specify Odd/Even)**	**Semester** VII **Session** 2018 -2019 **Month from** July 2019 – Dec 2019
Course Name	Applied Numerical Methods		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Prof. R. C. Mittal
	Teacher(s) (Alphabetically)	Prof. R. C. Mittal

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C401-8.1	solve system of linear equations using direct and iterative methods with their applications in various engineering problems.	Applying Level (C3)
C401-8.2	explain finite and divided difference formulae for numerical interpolation.	Understanding Level (C2)
C401-8.3	apply the methods of least squares to best fit the given data.	Applying Level (C3)
C401-8.4	apply numerical differentiation and integration in engineering applications.	Applying Level (C3)
C401-8.5	solve system of non-linear equations and analyze the convergence of the methods.	Analyzing Level (C4)
C401-8.6	evaluate the solutions of initial and boundary value problems using various numerical methods.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Numerical Linear Algebra	Gauss-elimination and LU-Decomposition, Iterative methods: Gauss Seidel. Power method for largest eigenvalues, Jacobi method for real symmetric matrices	10
2.	Interpolation and Approximation	Interpolating polynomial, Lagrange formula with error, Formulae for equispaced points, Divided differences, Hermite interpolation, Least square approximation	8
3.	Numerical Differentiation and quadrature	Approximation of derivatives, Newton-Cote formulae, Gauss-Legendre quadrature formulae, Double integration	8
4.	Non-linear Algebraic Equations	Iterative methods for one or more nonlinear equations with convergence	4
5.	Numerical Solutions of ODE and PDE	Runge-Kutta and predictor corrector methods for IVPs, Finite difference methods for BVPs, Shooting methods, Numerical solutions of parabolic and elliptic partial differential equations	12
		Total number of Lectures	**42**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz , Assignments, Tutorials)
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.	**Gerald, C.F. and Wheatley P.O.**, Applied Numerical Analysis, 6th Ed., Pearson Education, 1999.
2.	**Conte, S.D. and DeBoor, C.**, Elementary Numerical Analysis, 3rd Ed., McGraw-Hill, 1980.
3.	**Gupta, R.S.**, Elements of Numerical Analysis, 1st Ed., Macmillan 2009.
4.	**Jain, M.K., Iyengar, S.R.K. and Jain, R.K.**, Numerical Methods for Scientific and Engineering Computation 5th Ed., New Age International, New Delhi, 2007.
5.	**Smith, G.D.**, Numerical Solution of Partial Differential Equations, 2nd Ed., Oxford, 1978.

Department of Physics and Materials Science and Engineering

AY: 2019-20 (Odd Semester)

Course Opening Report

Programme Name: B.Tech.

Semester: VII

Course Name & Code: **Nanoscience and Technology (17B1NPH732)**

Course Outcomes:

At the completion of the course, students will be able to,

Sl. No.	Description	Cognitive Level
C401-4.1	Define the Nanoscience and Technology and to know about various other terminologies and developments involved with Nanoscience and Technology	C1
C401-4.2	Classify the nanomaterials depending on the nature of dimensionalities, type of materials classes and explain the basic concepts of nanomaterials	C2
C401-4.3	Apply the concepts of Nanoscience for solving the theoretical and numerical problems	C3
C401-4.4	Determine the properties of nanomaterials through suitable characterization tools	C5

CO-PO and CO-PSO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
C401-4.1	3	3										1	3	3
C401-4.2	3	3										1	3	3
C401-4.3	3	3										1	3	3
C401-4.4	3	3			3								3	3
Avg.	3	3			3							1	3	3

	CSE		IT		ECE		BT		
COs	PSO 1	PSO 2	PSO 1	PSO 1	PSO 1	PSO 2	PSO1	PSO2	PSO3
C401-4.1									
C401-4.2									
C401-4.3									
C401-4.4									

C401-4									

Identified Curriculum Gaps (If Any):

Topics to be introduced	Strengthens CO	Strengthens PO, PSO	Method of Identification
Nil	Nil	Nil	Nil

Modifications in Curriculum (If Any):

Details of Modification	Justification
Nil	Nil

Actions for Improving CO Attainments: ECE

COs	Attainments in 2018-19	Identified Gap	Action to be taken in 2019-20 to improve CO attainment
C401-4.1	2.0	Nil	
C401-4.2	2.0	Nil	
C401-4.3	2.2	Nil	
C401-4.4	2.8	Nil	

Actions for Improving CO Attainments: CSE

COs	Attainments in 2018-19	Identified Gap	Action to be taken in 2019-20 to improve CO attainment
C401-4.1	1.2	Students need to practice more for writing the definitions and concepts of course.	Assignments related to overview, definitions and fundamentals of Nanoscience and Technology would be given.
C401-4.2	1.2	Students need to be more aware of diverse nano-systems.	Oral quizzes would be held in class to make students prompt in classifications and types of diverse nanostructured materials.

C401-4.3	1.2	Students need to practice more for numerical solving.	Incorporate more numerical as the part of lectures.
C401-4.4	1.6	Students need to develop critical thinking based on the contents learnt in the course.	Two new assignments are designed for students which would prompt students to develop critical thinking and applying the knowledge learned.

Innovative Teaching and Learning Method to be used (if any): None

Innovative Evaluation Strategy to be used (If any): None

Signature:

Module Coordinator: Dr. N K Sharma

Signature:

Course Coordinator: Dr. Navendu Goswami

Syllabus Description

Course Code **NBA Code:**	17B2NCI731 432.6	**Semester** Odd B.Tech (CSE/IT)	**Semester VII Session** 2019 - 20 **Month from** July '19 **to** Dec '19
Subject Name	Computer Graphics		
Credits	3	**Contact Hours**	3-1-0

Faculty	**Coordinator**	Dr. Suma Dawn(62), Mr. Gaurav Nigam (128)
	Teacher(s)	Dr. Suma Dawn(62), Mr. Gaurav Nigam (128)

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	Data structures for modeling; Algorithms for Mesh generation, Clipping, 2D and 3D; Geometric Transformations, and so on; Geometric transformations: affine transformations	10

	Curved objects	(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;	
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

Course Code **NBA Code**	**18B12CS434** **CS434**	**Semester (Odd)**	**Semester** I **Session** 2019 -2020 **Month from** July - December
Course Name	Ethical Hacking		
Credits	04	**Contact Hours**	(L+T) (3+1)

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
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)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Introduction	Key issues plaguing the information security world, incident management process, and penetration testing	3
2	Footprinting	Various types of footprinting, footprinting tools, and countermeasures.	3
3	Scanning and Enumeration	Network scanning techniques and scanning countermeasures. Enumeration techniques and enumeration countermeasures	3
4	System Hacking	System hacking methodology, steganography, steganalysis attacks, and covering tracks	3
5	Malware and Virus	Different types of Trojans, Trojan analysis, and Trojan countermeasures. Working of viruses, virus analysis, computer worms, malware analysis procedure, and countermeasures	3
6	Sniffing	Packet sniffing techniques and how to defend against sniffing	3
7	Social Engineering	Social Engineering techniques, identify theft, and social engineering countermeasures	3
8	DoS Attacks	DoS/DDoS attack techniques, botnets, DDoS attack tools, and DoS/DDoS countermeasures	3
9	Session Hijacking	Session hijacking techniques and countermeasures	3
10	Web Servers and Apps	Dierent types of webserver attacks, attack methodology, and countermeasures. Dierent types of web application attacks, web application hacking methodology, and	3

		countermeasures	
11	SQL Injection	SQL injection attacks and injection detection tools	3
12	Hacking WiFi and Bluetooth	Wireless Encryption, wireless hacking methodology, wireless hacking tools, and wi-fi security tools	3
13	Mobile Hacking and Security	Mobile platform attack vector, android vulnerabilities, jailbreaking iOS, windows phone 8 vulnerabilities, mobile security guidelines, and tools	3
14	IT Act 2008	Indian Information Technology Act 2000 and IT Amendment Act 2008	3
15	Pentesting Report	Various types of penetration testing, security audit, vulnerability assessment, and penetration testing roadmap	3
		Total number of Lectures	**45**

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.	Sean-Philip Oriyano, "Certified Ethical Hacker Version 9 - Study Guide", EXAM 312-50, Sybex Wiely, 2016.
2.	Georgia Weidman, "Penetration testing A Hands-On Introduction to Hacking", No Scratch Press, 2014.
3.	Raphaël Hertzog, Jim O'Gorman, and Mati AharoniKali, "Linux Revealed Mastering the Penetration Testing Distribution", OFFSEC Press, 2017
4.	Corey P. Schultz, Bob Percianccante, "Kali Linux Cook Book", Second edition, Packet Publishing, 2017.
5.	Lee Allen, Tedi Heriyanto, Shakeel Ali, "Kali Linux – Assuring Security by Penetration Testing, Packet Publishing, 2014.
6.	Dejey, Murugan, "Cyber Forensics", Oxoford University Press, 2018.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	15B1NCI738	**Semester :odd**	**Semester 7th Session 2019- 2020 Month from July to December**
Subject Name	Social Network Analysis		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	1. Somya Jain (62) 2. Anuradha Gupta(128),
	Teacher(s) (Alphabetically)	Anuradha Gupta, Somya Jain
2		

COURSE OUTCOMES		**COGNITIVE LEVELS**
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.	Analyze 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 a.	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	3
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	**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.	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

Summer Training viva 15B19CI753, 15B29CI753

Course Objectives

S.N.	Description	Cognitive Level (Bloom's Taxonomy)
1.	Summarize the contemporary activities with respect to their module, and explored tools for hands-on in the respective project area	Understand Level (Level-2)
2.	Analyse industry requirements and work culture	Analyze Level (Level-4)
3.	Apply technical knowledge to construct computing-based solution with respect to the identified problem at industry/institute.	Apply Level (Level-3)
4.	Interpret and critically evaluate the solution for the problem.	Evaluate Level (Level-5)
5.	1. Create written discourse for presentation of work done at industry/institute.	Create Level (Level-6)

Course Code	15B19CI791	**Semester** ODD **(specify Odd/Even)**	**Semester** VII **Session** 2019 -2020 **Month from July** to Dec 2019
Course Name	**Project Part – 1 (IT)**		
Credits	12	**Contact Hours**	…

Faculty (Names)	**Coordinator(s)**	Dr. Mukta Goyal Prashant Kaushik
	Teacher(s) (Alphabetically)	Entire Department

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	Compile the results and findings of the project in written and verbal formats	Create Level (Level 6)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	…	…	…
2.	…	…	…
3.	…	…	…
4.	…	…	…
5.	…	…	…
...	…	…	…
***n*.**	…	…	…

Evaluation Criteria

Components	**Maximum Marks**
Mid Semester Viva	20
Final Viva	30
Project Report	20

Day to Day Work	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)

Course Code	15B29CI792	**Semester** ODD **(specify Odd/Even)**	**Semester** VII **Session** 2019 -2020 **Month from** July to Dec 2019
Course Name	**Term Paper (IT)**		
Credits	4	**Contact Hours**	…

Faculty (Names)	**Coordinator(s)**	Indu Chawla(J62), Somya Jain (62), Gaurav Kumar Nigam(J128)
	Teacher(s) (Alphabetically)	Entire Department

COURSE OUTCOMES		**COGNITIVE LEVELS**
C460.1	Infer the research problem stated along with the research methodologies used and their significance.	**Understand level (level 2)**
C460 .2	Appraise technical writing skills to compare and summarize the nature of work done so far in that area.	**Evaluate level (level 5)**
C460 .3	Develop effective communication skills to confidently justify theoretical propositions, methodologies, conclusions and limitations by preparing and presenting a seminar	**Create level (level 6)**

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	…	…	…
2.	…	…	…
3.	…	…	…
4.	…	…	…
5.	…	…	…
...	…	…	…
***n*.**	…	…	…

Evaluation Criteria	
Components	**Maximum Marks**
Day to day work done prior to Midterm	20

Midterm seminar and report	20
Day to day work done after Midterm & upto End Term seminar	20
End term report	20
End term seminar	20
Total	**100**

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NCI733**	**Semester** Odd	**Semester** VII **Session** 2019 -2020 **Month from** July'19 to December'19
Course Name	**Data Compression Algorithms**		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. TRIBHUWAN KUMAR TEWARI/ Dr. SHRUTI JAISWAL
	Teacher(s) (Alphabetically)	Dr. SHRUTI JAISWAL Dr. TRIBHUWAN KUMAR TEWARI

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO 430-3.1	Explain and summarize theoretical and practical significance of various mathematical concepts of data compression	Understand Level (Level 2)
CO 430-3.2	Demonstrate lossless and lossy compression techniques for images, videos, audios, etc	Understand Level (Level 2)
CO 430-3.3	Applying different data compression algorithms for solving complex problems	Apply Level (Level 3)
CO 430-3.4	Analyze the techniques for compression of binary data, image, audio and video	Analyze Level(Level 4)
CO 430-3.5	Elaborate new trends and possibilities of data compression for redesigning of algorithms.	Create Level(Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction: Importance of data compression, Brief history, Compression principles, Compression Performance metrics, Lossless and lossy data compression.	3
2	Main compression techniques	Data compression classification, lossless compression algorithms, Run length encoding (RLE), Statistical methods-Huffman, Extended Huffman, Adaptive Huffman, Canonical Huffman, length limited Codes, Arithmetic Coding, Dictionary-based methods, Transforms.	10
3.	Image compression	Lossless image compression, Predictive encoding, JPEG lossless coding, Lossy compression, Distortion measures, Progressive image compression, Karhunen-Loeve Transform (KLT), Singular Value decomposition (SVD), JPEG (Still) Image Compression Standard ,Transform-based coding.	8
4.	Video compression	Video compression techniques, predictive coding. MPEG video coding, MPEG-1, B-frame predictive coding, MPEG-2, Supporting interlace video. MPEG-2 scalabilities. MPEG video coding -2, MPEG-4, object based video coding, 3D mesh coding. MPEG-4 part 10/ H.264.	10
5.	Audio compression	Introduction Audio compressions. Quantization and transmission of audio, pulse code modulation (PCM),	8

		Differential coding of audio, lossless predictive coding, DPCM, DM. MPEG audio compression , Psychoacoustics, frequency masking, temporal masking, MPEG layers 1-2-3(MP3), MPEG compression algorithm. MPEG-2 advance coding system (AAC), MPEG-4 audio compression.	
6.	Compression problems & Algorithmic solutions	Compression performance, Limits on lossless compression, Hardware data compression (HDC).	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance(10), Assignments (5), Implementation of Algorithms (10))
Total	**100**

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

1	Salomon, David A Guide to Data Compression Methods. (London: Springer, 2001) [ISBN 0-387-95260-8].
2	Fundamentals of multimedia by Ze-Nian Li and Mark S. Drew Pearson Education -PHI learning 2004
3	Wayner, Peter Compression Algorithms for Real Programmers. (London: Morgan Kaufmann, 2000) [ISBN 0-12-788774-1].
4	Sayood, Khalid Introduction to Data Compression. 2nd edition (San Diego: Morgan Kaufmann, 2000) [ISBN 1-55860-558-4].
5.	Chapman, Nigel and Chapman, Jenny Digital Multimedia. (Chichester: John Wiley & Sons, 2000) [ISBN 0-471-98386-1].
***m*.**	…

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NCI833	**Semester ODD (specify Odd/Even)**	**Semester** VII **Session** 2019-20 **Month from** June 2019 to December 2019
Course Name	Nature Inspired Computing		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Ankita Verma
	Teacher(s) (Alphabetically)	Dr. Ankita Verma, Ms. Deepti Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-4.1	Explain the concepts of problem solving via search, optimization and pattern recognition with various practical examples.	Understand Level (C2)
C430-4.2	Apply the NIC methods to model, learn and optimize computing problems.	Apply Level (C3)
C430-4.3	Analyze the key ideas, algorithmic steps of various nature inspired computing methods and their general applicability in various domains.	Analyze Level (C4)
C430-4.4	Compare and contrast the similarities and differences among various nature inspired computing methods.	Evaluate Level (C5)
C430-4.5	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; Optimization: Continuous vs Combinatorial optimization, Single objective vs Multi-objective optimization, Implicit vs Explicit Constraints; Pattern Recognition.	4
2.	Meta-Heuristic Search Algorithms	Heuristics and Meta-heuristics; Problem Spaces: States, goals and operators; Heuristics search: Hill Climbing and Simulated Annealing, Tabu search	3
3.	Evolutionary Algorithms (EA)	Genetic Algorithms: Introduction, General framework, Encoding Techniques, Selection Operators, Crossover Techniques, Mutation Operators, Replacement Strategies. Differential Evolution: Introduction, Algorithm, Crossover	6

		Techniques, Mutation Techniques, Genetic vs DE, Examples	
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.	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 Systems)	7
6.	Bio-Inspired Algorithms	Artificial Bee Colony: Introduction, Algorithm and worked example; Grey Wolf Optimization: Introduction, Algorithm and worked example; Cuckoo Search: Introduction, Algorithm and worked example; Fire-fly algorithm: Introduction, Algorithm and worked example; Bat Algorithm: Introduction, Algorithm and worked example	10
7.	Algorithms based on Physical Laws and miscellaneous algorithms	Gravitational Search Algorithm: Introduction, Algorithm and worked example; Intelligent water drops (IWD) algorithm: Introduction, Algorithm and worked example; Biogeography Based Optimization: Introduction, Algorithm and worked example	6
8.	Artificial Immune System	Immune System and Immunity; Artificial Immune System(AIS); Biological Immune System(BIS) vs Artificial Immune System(AIS); Typical Applications of AIS; General framework for AIS: Problem Representation, Affinity measure, Selection, Mutation; Basic Arificial Immune Models and Algorithms: Negative Selection Algorithms, Clonal Selection Algorithm, Immune Network Models; Movie Recommender System using AIS.	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance and Tutorial submission)
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
6.	Natural Computing : Springer

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS831**	**Semester: Odd (specify Odd/Even)**	**Semester: VII Session** 2019 -2020 **Month: July-Dec**
Course Name	Gender Studies		
Credits	3	**Contact Hours**	(3-0-0)

Faculty (Names)	**Coordinator(s)**	Dr Parineeta Singh
	Teacher(s) (Alphabetically)	Dr Parineeta Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-19.1	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)
C401 -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)
C401-19.3	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)
C401-19.4	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporary settings	Evaluate (C5)
C401-19.5	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 Body & Language**	• Biological, Phenomenological and Socio-Cultural Perspectives of body • Body as a Site and Articulation of Power Relations • Cultural Meaning of Female Body and Women's Lived Experiences • The Other and Objectification	8
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 &	9

		Celebrating Womanhood • Analysis of role women have played across cultures	
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, 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	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	17B1NBT732	**Semester** Odd **(specify Odd/Even)**	**Semester VII Session** 2019 -2020 **Month from** July-December
Course Name	Healthcare Marketplace		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Indira P. Sarethy
	Teacher(s) (Alphabetically)	Dr. Indira P. Sarethy, Dr. Shweta Dang

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-14.1	Explain healthcare market, drugs and devices, role of various stakeholders	Understand Level (C2)
C401-14.2	Apply related intellectual property laws and regulatory approvals for healthcare sector	Apply Level (C3)
C401-14.3	Analyze the various business models/ innovations in the healthcare industry	AnalyzeLevel (C4)
C401-14.4	Compare and examine economic aspects pertaining to the sector	AnalyzeLevel (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Healthcare markets**	About the various Regulatory bodies for approval of new medical innovations	**02**
2.	**Clinical Pharmacokinetics and Clinical trials for new Drugs**	Biologic sampling techniques, analytical methods for the measurement of drugs and metabolites, and procedures that facilitate data collection and manipulation. Clinical Trials: PhI, II, III and IV	**05**
3.	**Regulatory approval pathways**	Preclinical studies US and EU filings IND submissions, NDA and BLA Submissions, Non-patent exclusivities, data and market exclusivities cost analysis	**06**
4.	**Patents of drugs and devices, Entry for generics in health care markets**	Role of patents on new drugs and devices, Ever-greening of patents, Product and Process patents. Hatch Waxman act and Introduction of generics and resulting cost reduction, Orange book (FDA) and related case studies.	**08**
5.	**Economics of healthcare**	Stakeholders in healthcare- doctors, hospitals and insurers and theirroles, technology and human capital	**7**
6.	**Medical technology and insurance**	For medical devices, pharmaceuticals, genetic diagnostic tests and their regulations	**4**
7.	**Indian hospital sector**	Various players – government, private, PPP models, strategic perspectives, case studies	**4**

8	**Innovations in the marketplace**	Health to market innovations	**4**
9	**Healthcare informatics**	e-health, collection of health data, data processing, evaluation, health information systems, case studies	**2**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments 1, 2, 3, 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.	Research papers and online resources

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NBT733	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2019 -2020 **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; Happy Interactive Class (HIC)	3
2.	Scientific Foundations of Stress	HIC 1, The Nature of Stress; Human Physiology; Stress and Relaxation Responses; Stress and Disease	5
3.	Body Systems activated by stressors	HIC2, Nervous System, Endocrine System, immune system, Cardiovascular system, Gastrointestinal System, Muscles	9
4.	Cognitive Psychology	HIC3, 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	11
5.	Social Psychology	HIC4, Family and Culture; Demands and Responsibilities; Relationships; Verbal and Non-verbal Communication; Human Spirituality	3
6.	Stress and the Human Environmental Interactions	HIC4, Time; Body Rhythms; Weather and Climate; Nutrition; Exercise; Drugs and Addictions; Violence and Post Traumatic Stress	3
7.	Happy Interactive Class (HIC) related to Stress management	HIC1 - DIY Strategies- Exercise and Health; HIC2 - Journal Writing/Music and Art Therapy; HIC3- Humor and Comic Relief; HIC4- Meditation/Mindfulness/Belly Breathing/Visual Imagery/Progressive Muscle Relaxation	HICs to be delivered in the modules 1-6

	techniques and therapeutic strategies	Psychological interventions; Developing Cognitive Coping Skills; Creative Problem Solving (case studies);	4
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

Subject Code	17B1NCI731	**Semester Odd (specify Odd/Even)**	**Semester VII Session** 2019 - 20 **Month from** July,19 to December,19
Subject Name	Machine Learning and Natural Language Processing		
Credits	4	**Contact Hours**	4

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-2.1	Explain different syntax and semantics approaches in NLP	Understand Level [Level 2]
C430-2.2	Understand the fundamental mathematics applied in the field of NLP	Understand Level [Level 2]
C430-2.3	Apply different models like Hidden Markov Model, SVM, CRF, RNN, LSTM in parts of speech tagging	Apply Level [Level 3]
C430-2.4	Apply different probabilistic parsing techniques in NLP	Apply Level [Level 3]
C430-2.5	Apply different supervised and unsupervised techniques for document classification	Apply Level [Level 3]
C430-2.6	Analyze and apply appropriate Machine Learning techniques to solve the real world problem in NLP	Apply Level [Level 3]

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1	Introduction to Machine Learning & NLP	Introduction to Machine Learning & NLP, Challenges & Requirements	3
2	Mathematical Foundation	Probability Theory, Vector Spaces, Matrix algebra, Probability, Data representation, Tokenization, Lemmatization	5
3	Parts of Speech Tagging	Various Models: Hidden Markov Model, SVM, CRF, RNN, LSTM	11
4.	Parsing	Linguistic Essentials, Markov Models, Applications of tagging, Probabilistic parsing - CFG, CNF, CYK	8

5.	Document classification	Supervised: Naive Bayes, Ngram's model, Sentiment analysis, Text classification, Unsupervised: K-means, MaxEnt classifier	8
6.	Topic Modelling	Latent Dirichlet Allocation (LDA) and its variants	2
7.	Applications	Machine Translation, Question Answering	4
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
TA	**25 (Attendance and Tut Performance (5), Quiz/ Mini-Project/Assignment (20))**
Total	**100**

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

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (third edition) Daniel Jurafsky and J. Martin
2. Handbook of Natural Language Processing & Machine Translation by Olive, Joseph, Christianson, Caitlin, McCary, John (Eds.), Springer
3. Statistical Machine Translation by Philipp Koehn, Cambridge University Press
4. Readings in Machine Translation edited by Sergei Nirenburg, H. L. Somers, Yorick Wilks, MIT Press
5. Natural Language Understanding by James Allen, Benjamin Cummins Publisher
6. Foundations of Statistical NLP by Hinrich Schtze, Christopher D. Manning
7. Natural Language Processing with Python by Steven Bird, Ewan Klein, and Edward Loper