

### Course Description

<b>Course Code</b>	15B19CI791	<b>Semester ODD</b> (specify Odd/Even)	<b>Semester VII Session 2022 -2023</b> <b>Month from July to Dec 2022</b>
<b>Course Name</b>	<b>Major Project Part – 1 (INTG)</b>		
<b>Credits</b>	4	<b>Contact Hours</b>	...

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Prashant Kaushik
	<b>Teacher(s)</b> (Alphabetically)	Entire Department

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C450.1</b>	Summarize the contemporary literature and explore tools for hands-on in the respective project area	Understand Level (Level 2)
<b>C450.2</b>	List out the specific requirements to develop the workable solution for the identified computing problem	Analyze Level (Level 4)
<b>C450.3</b>	Develop a working model for the identified problem	Apply Level (Level 3)
<b>C450.4</b>	Inspect the developed solution using exhaustive test cases and evaluate its performance using statistical methods and relevant metrics	Evaluate Level (Level 5)
<b>C450.5</b>	Report the results and findings of the project in written and verbal formats	Create Level (Level 6)

<b>Module No.</b>	<b>Title of the Module</b>	<b>List of Experiments</b>	<b>CO</b>
1.	...	...	...
2.	...	...	...
...	...	...	...
<i>n.</i>	...	...	...

<b>Evaluation Criteria</b>	
<b>Components</b>	<b>Maximum Marks</b>
Mid Semester Viva	20
Final Viva	30
Project Report	20
Day to Day Work	30
<b>Total</b>	<b>100</b>

**Project based learning:** Each student in a group of 2-3 will have to develop a Major Project based on different real-world problems using any open-source programming language. Students have to study the state-of-the-art methods before finalizing the objectives. Project development will enhance the knowledge and employability of the students in IT sector.

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	16B1NCI648	<b>Semester -Odd</b> (specify Odd/Even)	<b>Semester VII Session 2022-2023</b> <b>Month from: July 22- Dec 22</b>
<b>Course Name</b>	Information Retrieval and Semantic Web		
<b>Credits</b>	3	<b>Contact Hours</b>	3 – 0 -- 0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Neetu Sardana, Dr Devpriya Soni
	<b>Teacher(s)</b> (Alphabetically)	Dr Devpriya Soni, Dr. Neetu Sardana

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
C430.11.1	Design and implement information retrieval systems for unstructured data.	Apply Level (Level 3)
C430-11.2	Apply query processing techniques for tolerant retrieval.	Apply Level (Level 3)
C430-11.3	Analyze Information retrieval models and their metrics.	Analyze Level (Level 4)
C430-11.4	Analyze the searching algorithms for Information Retrieval.	Analyze Level (Level 4)
C430-11.5	Demonstrate the web crawling, taxonomy and ontology of web applications	Apply Level (Level 3)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Introduction to Information Retrieval	Theory of information retrieval, Information retrieval on Data and information retrieval on the Web Information retrieval tools and their architecture.	4
2.	Boolean Retrieval & Index Construction	An example information retrieval problem, Processing Boolean queries, The extended Boolean model versus ranked retrieval, Blocked sort based, single pass in Memory, Distributed and dynamic Indexing.	6
3.	Dictionary and tolerant retrieval	Wild card queries, Spelling correction, Phonetic correction	4
4.	Scoring Term weighting and the vector space model	Term frequency and weighting, Vector space model, Variant TF-IDF Scoring, Probabilistic Model, Evaluation of IR System	4
5.	Link analysis	Web as graph, PageRank	4
6.	Information retrieval tools	Web directory, Search engine, Meta search engines, Web searching and search engine architecture, Searching Algorithms (Fish, Shark etc...), and Page ranking algorithms.	6
7.	Web Crawling	WebCrawler architecture and Web crawling (parallel, distributed and focused web crawling).	6
8.	Taxonomy and Ontology	Creating domain specific ontology, Ontology life cycle Semantic Web: Resource description Framework (RDF),	8

		Turtle format, Storing RDF in Databases/files, Language Tags and labels in RDF files, RDF schema and web ontology language (OWL).	
<b>Total number of Lectures</b>			<b>42</b>

**Evaluation Criteria**

<b>Components</b>	<b>MaximumMarks</b>
T1	20
T2	20
EndSemesterExamination	35
TA	25 (Attendance = 10, Assignment & Quiz= 05, Mini Project= 10)
<b>Total</b>	<b>100</b>

The students in the group of 3-4 will choose one of the information retrieval algorithms such as Index construction, Query Processing, spelling correction, vector space modeling, Link Analysis etc. The chosen algorithm will be applied in context to some application area preferably on some standard dataset taken from the platforms like Kaggle, Github, UCI, KDD etc. Applying these algorithms on standard dataset will enable the students in enhancing their understanding and skills towards Information retrieval.

**Recommended Reading material:**

**Text Books**

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, "An introduction to Information Retrieval", 2013 Cambridge University Press UP.
2. Rijsbergen C. J. 2012, "Information Retrieval", 2<sup>nd</sup> edition.

**Reference Books**

1. Salton, G. and McGill, M.J., "Introduction to Modern Information Retrieval", Computer Series. McGraw-Hill, New York, NY.
2. ACM Transaction on Internet Technology.

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	17B1NBT732	<b>Semester Odd</b> (specify Odd/Even)	<b>Semester VII Session</b> 2022-2023 <b>Month from</b> Aug - Dec
<b>Course Name</b>	Healthcare Marketplace		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Shweta Dang
	<b>Teacher(s)</b> (Alphabetically)	Dr. Indira P. Sarethy, Dr. Shweta Dang

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>CO1</b>	Explain healthcare market, drugs and devices, role of various stakeholders	Understand Level (C2)
<b>CO2</b>	Apply related intellectual property laws and regulatory approvals for healthcare sector	Apply Level (C3)
<b>CO3</b>	Analyze the various business models/ innovations in the healthcare industry	Analyze Level (C4)
<b>CO4</b>	Compare economic aspects pertaining to the sector	Analyze Level (C4)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	<b>Introduction to Healthcare markets</b>	About the various Regulatory bodies for approval of new medical innovations 2 [CO1] Level 2 Understanding	<b>02</b>
2.	<b>Clinical Pharmacokinetics and Clinical trials for new Drugs</b>	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 [CO2] Level 3 Applying	<b>05</b>
3.	<b>Regulatory approval pathways</b>	Preclinical studies US and EU filings IND submissions, NDA and BLA Submissions, Non-patent exclusivities, data and market exclusivities cost analysis [CO2] Level 3 Applying	<b>06</b>
4.	<b>Patents of drugs and devices, Entry for generics in health care markets</b>	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. [CO2] Level 3 Applying	<b>08</b>
5.	<b>Economics of healthcare</b>	Stakeholders in healthcare- doctors, hospitals and insurers and their roles, technology and human capital [CO1] Level 2 Understanding	<b>7</b>
6.	<b>Medical technology and insurance</b>	For medical devices, pharmaceuticals, genetic diagnostic tests and their regulations [CO3] Level 4 Analyzing	<b>4</b>

7.	<b>Indian hospital sector</b>	Various players – government, private, PPP models, strategic perspectives, case studies [CO3] Level 4 Analyzing	4
8	<b>Innovations in the marketplace</b>	Health to market innovations [CO3] Level 4 Analyzing	4
9	<b>Healthcare informatics</b>	e-health, collection of health data, data processing, evaluation, health information systems, case studies [CO3] Level 4 Analyzing	2
<b>Total number of Lectures</b>			<b>42</b>

**Project Based Learning:** Students analyze the site <https://pmjay.gov.in/about/pmjay>, understand the following sections:

- Coverage under PM-JAY
- Implementation Model
- Financing of the Scheme

And represent them in one comprehensive diagram, integrating all the above components. This helps them in understanding recent innovations in healthcare market and integration of healthcare informatics.

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (PBL, Assignments 1, 2, 3, Attendance)
<b>Total</b>	<b>100</b>

**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 href="https://www.who.int/nationalpolicies/processes/stakeholders/en/">https://www.who.int/nationalpolicies/processes/stakeholders/en/</a>
2.	Conflict of interests. I. Lo, Bernard. II. Field, Marilyn J. (Marilyn Jane) III. Institute of Medicine (U.S.). Committee on Conflict of Interest in Medical Research, Education, and Practice. IV. National Academies Press (U.S.), 2009
3.	Research papers and online resources

**Detailed Syllabus**  
**Lecture-wise**  
**Breakup**

<b>Subject Code</b>	<b>17B1NHS733</b>	<b>Semester: ODD</b>	<b>Semester: VII Session 2022-23</b> <b>Month: July- December</b>
<b>Subject Name</b>	<b>Human Rights and Social Justice</b>		
<b>Credits</b>	<b>3 (3-0-0)</b>	<b>Contact Hours</b>	<b>(3-0-0)</b>

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	<b>Dr. Namreeta Kumari</b>
	<b>Teacher</b>	<b>Dr. Namreeta Kumari</b>

<b>CO Code</b>	<b>COURSE OUTCOMES</b>	<b>COGNITIVE LEVELS</b>
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	<ul style="list-style-type: none"> <li>● Meaning and Concept of Human Rights &amp; Social Justice</li> <li>● Notion and Classification of Rights: Natural, Moral and Legal Rights,</li> <li>● Concept of Civil Rights</li> <li>● Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights; Collective/Solidarity Rights), Distinction between CPR &amp; ESCR</li> </ul>	6
2.	Evolution of Human Rights	<p>Human Rights in Middle Ages:</p> <ul style="list-style-type: none"> <li>● Magna Carta</li> </ul> <p>Modern Movement for Human Rights:</p> <ul style="list-style-type: none"> <li>● The United States Declaration of Independence</li> <li>● The French Declaration of the Rights of Man and the Citizen</li> <li>● United States Bill of Rights</li> <li>● Geneva Convention of 1864</li> </ul>	9
3.	International Human Rights Standards	<ul style="list-style-type: none"> <li>● Universal Declaration of Human Rights, 1948.</li> <li>● International Covenant on Civil and Political Rights, 1966</li> <li>● International Covenant on Economic, Social and Cultural Rights, 1966</li> </ul>	8
4.	Human Rights of the specially disadvantaged sections of the society	<ul style="list-style-type: none"> <li>● Scheduled Castes/Scheduled Tribes and Other Backward Classes: Caste Prejudice and Discrimination</li> <li>● Minorities: Human Rights Issues of Ethnic minorities</li> <li>● Women and Children: Gender Discrimination, Domestic Violence and Offences against Women; Gender Sensitive Laws, Children: Child Abuse, Child Labour, Street Children</li> <li>● Aged and Disabled Persons: Vulnerability and social taboos</li> </ul>	8
5.	Human Rights of the Working Class	<ul style="list-style-type: none"> <li>● Migrant Workers</li> <li>● Bonded Labourers</li> <li>● Agricultural Labourers</li> <li>● Casual Workers</li> </ul>	5
6.	Emerging Dimensions Of Human Rights	<ul style="list-style-type: none"> <li>● National Sovereignty versus 'international enforcement' of human rights</li> <li>● International politics of human rights and selective application of international sanctions</li> <li>● Unilateral use of coercion and implementation of</li> </ul>	6

		human rights ● Human rights, and science and technology	
Total number of Hours			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>	<b>Maximum Marks</b>		
T1	20		
T2	20		
End Semester Examination	35		
TA	25 (assignment)		
<b>Total</b>	<b>100</b>		

Project Based Learning: The students will be required to form groups of 4-5 and review documentaries/movies which are based on the violation/issues of human rights and social justice

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



**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	17B1NPH732	<b>Semester: ODD</b>	<b>Semester: 7<sup>th</sup> Session: 2022 -2023</b> <b>Month from July to December</b>
<b>Course Name</b>	Nanoscience and Technology		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Prof. Navendu Goswami Dr. Sandeep Chhoker
	<b>Teacher(s) (Alphabetically)</b>	Prof. Navendu Goswami Dr. Sandeep Chhoker

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Introduction	Development of nanoscience and nanotechnology, naturally occurring nanomaterials, Crystallinity of nanomaterials, Metallic nanostructures, Semiconductor nanostructures, Magnetic nanomaterials, Chemically assisted nanostructures, Growth in 2-D nanostructures, Carbon nanomaterials	10
2.	Properties of Nanomaterials	Surface to volume ratio, Surface states and energy, Nanoscale oscillators, Confinement in nanostructures, Density of States and number of states of 0-, 1-, 2-, 3-dimensional systems, Change in Band structure and gap, Energy levels, confinement energy and emission in nano, Fluorescence by QDs, Concept of Single electron transistor	5
3.	Nanomaterials Synthesis	Introduction to synthesis techniques, Top down and bottom up approach, Biological methods, Sol-gel method, Nucleation and growth, Ball Milling technique, Chemical vapor deposition, Physical Vapor deposition: Concept of Epitaxy and sputtering, Basics of Photolithography and its limitations, Soft Lithography and Nanolithography	10
4.	Characterization of Nanomaterials	Resolving power (Rayleigh and other criteria) of microscopes and their limitations for nanostructure measurements, Concept of Far and Near field and modification by NSOM, Basic principle, Design of setup, Theory and working, Characterization procedure, result analysis, Merits/demerits of SEM, TEM, STM, AFM	5

5.	Application of Nanomaterials	Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High T <sub>c</sub> nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS	10
<b>Total number of Lectures</b>			<b>40</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 [PBL (6 M), 2 Quiz (7 M), Attendance (7 M) and Internal Assessment (5 M)]	
<b>Total</b>		<b>100</b>	

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	<i>Nanostructures and nanomaterials: synthesis properties and application</i> , Guozhong Cao, Imperial college press, London.
2.	<i>Introduction to nanotechnology</i> , Charles Poole <i>et al</i> J John Wiley & Sons, Singapore.
3.	<i>The Handbook of Nanotechnology: Nanometer Structures, Theory, Modeling, and Simulation</i> , A. Lakhtakia, Spie Press USA.
4.	<i>Springer Handbook of Nanotechnology</i> , Edited by B. Bhushan, Springer Verlag.

**Project based learning:** Students would work on a project of their choice in the field of Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High T<sub>c</sub> nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS. In such projects students can apply the basic concepts of Nanoscience for solving theoretical and numerical problems. They can also work on analysis of a nanomaterial to determine its properties through suitable characterization tools such as SEM, TEM, AFM etc. The learning gained through this project would consolidate the understanding and provide skills of analysis and application in Nanoscience and Technology and thereby providing the employability prospects in the organizations and industries involved in the research and development of nanomaterials synthesis and characterizations, nanoelectronics, nanobiotechnology/nanomedicine etc.

## Detailed Syllabus

### Lecture-wise Breakup

<b>Subject Code</b>	17M11CS111	<b>Semester Odd (specify Odd/Even)</b>	<b>Semester Odd Session 2022-2023 Month from July 22 to December 22</b>
<b>Subject Name</b>	Data structure & Algorithms for Big Data		
<b>Credits</b>	3	<b>Contact Hours</b>	3(L)

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Indu Chawla
	<b>Teacher(s) (Alphabetically)</b>	Indu Chawla

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

<b>S.N.</b>	<b>Subtitle of the Module</b>	<b>Topics in the module</b>	<b>No. of Lectures for the module</b>	<b>Remarks</b>
1.	Introduction to Big Data	Motivation, Application, Domains for Big Data, Various tools and services	2	
2.	Basics of Hadoop	Introduction to hadoop. Introduction to HDFS, Read and write operation, Fault Tolerance-Failures and Recovery,:	3	
3.	MapReduce	Introduction to MapReduce, Mapreduce Job scheduling	3	
4.	Basic data structures	Array: searching, sorting,	4	

	concepts	aggregation on BIG DATA		
5.	Basic Statistics	Various types of parametric and non-parametric test	2	
6.	Matrix Multiplication	Matrix Multiplication for BIG DATA	2	
7.	Concurrency Control	Concurrency-control mechanisms, Multithreading, Transactions, logging, ACID compliant, crash recovery	5	
7.	Graphs	Spanning Tree (Min/Max), Searching (BFS), Shortest Path etc.	6	
8.	Indexing strategies Trees	large Arrays, Hashing, AVL, B-tree, Tries, R and R+ Trees, Prefix Trees, Accumulo, Bigtable, bLSM, Cassandra, HBase, Hypertable, LevelDB are LSM trees, divide & conquer, mapreduce	6	
9.	Bloom filters	Bloom filters, HyperLogLog, Count-2 min sketch	4	
10	Applications (may use spark)	Streaming Algorithms, Sublinear optimization, Machine Learning Problems, Hadoop systems	2	
11	Mathematical Foundation	Sparse: Vector Spaces, Matrix algebra, LSI, SVD, PSD	3	
<b>Total number of Lectures</b>			<b>42</b>	

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 Attendance (10 Marks), Assignment/Quiz/Mini-project (15 Marks)
<b>Total</b>	<b>100</b>

Project based learning: Students in group of 3 to 4 students are required to develop mini-project based on the concepts taught in this course. In mini-project, students need to create the distributed environment either using Hadoop framework or multithreading using OpenMP. Problem statements need to be formulated in various applications domains of big data, proposing the solution approach and implemented over the created distributed environment.

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

1. Journals: IEEE Transactions on Knowledge and Data Engineering, ACM Transactions on Intelligent Systems and

	Technology (TIST), ACM Transactions on Knowledge Discovery from Data (TKDD)
2.	2. Tier-1 Conferences: SIGKDD, ICDE - International Conference on Data Engineering, CIKM - International Conference on Information and Knowledge Management, ICDM - IEEE International Conference on Data Mining, SDM - SIAM International Conference on Data Mining, PKDD - Principles of Data Mining and Knowledge Discovery, IEEE Big Data
3.	<a href="https://journalofbigdata.springeropen.com/">https://journalofbigdata.springeropen.com/</a> <a href="https://www.springer.com/journal/41060">https://www.springer.com/journal/41060</a>
4.	4. Book: Mahmoud Parsian, "Data Algorithms: Recipes for Scaling Up with Hadoop and Spark", O'Reilly Media
5.	Probabilistic Data Structures and Algorithms in Big Data Applications by Andrii Gakhov
6.	Algorithms and Data Structures for Massive Datasets by Dzejla Medjedovic, Emin Tahirovic, and Ines Dedovic, MEAP began July 2020

**Detailed Syllabus**

**Lecture-wise**

**Breakup**

<b>Subject Code</b>	17M11CS112	<b>Semester (specify Odd/ Even):</b> Odd	<b>Semester:</b> Odd <b>Session</b> 2022-2023 <b>Month</b> from July to December
<b>Subject Name</b>	Machine Learning and Data Mining		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Anita Sahoo
	<b>Teacher(s)</b>	Anita Sahoo

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
C112.1	Differentiate between Classification, Clustering and Association Rules techniques.	Level 4 (Analyze)
C112.2	Understand working of classification techniques, e.g., k-Nearest Neighbours, Naïve Bayes, ID3 Decision Trees, Support Vector Machine, Ensemble methods.	Level-2- (Understanding)
C112.3	Apply and compare different clustering techniques, e.g., k-means, k-medoids, etc.	Level-3 (Apply)
C112.4	Evaluate different dimensionality reduction techniques e.g. PCA, SVD, Factor Analysis, Linear Discriminant Analysis, etc., in big data scenarios.	Level-5 (Evaluate)
C112.5	Apply various Artificial Neural Network Models for classification and clustering	Level-3 (Apply)

<b>Module No.</b>	<b>Subtitle of the Module</b>	<b>Topics in the module</b>	<b>No. of Lectures for the module</b>
1	Introduction	Introduction to Machine Learning, Data Mining and Knowledge Discovery in Data Bases, Data Types	2
2	Classification	Introduction to classification, k-Nearest Neighbours, Naïve Bayes, Decision Trees, Advanced classification techniques	6
3	Regression	Linear Regression with One Variable, Linear Regression with Multiple Variables, Logistic Regression	4
4.	Clustering	Introduction, Different type of Clustering Methods, Partitioning Clustering Methods, Hierarchical Clustering Methods, k-means, k-medoids, density based clustering, cluster validation	8
5.	Association Rules	Support, Confidence, Lift, Conviction; Apriori algorithm, Eclat algorithm, FP-growth algorithm	4
6.	Dimensionality Reduction	Introduction, Subset Selection, PCA, SVD, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis	6
7.	Artificial Neural Methods	Cost Function, Back propagation, Feed forward Network, Gradient Descent, Network training, Error Propagation, Application of Neural Networks, Introduction to quantum neural network	8
8.	Ensemble Methods	Ensemble methods of classification-Bagging, Boosting, and Random Forest	4
<b>Total number of Lectures</b>			42

**Evaluation Criteria**

<b>Components</b>	<b>Maximum</b>
<b>Marks T1</b>	<b>20</b>
<b>T2</b>	<b>20</b>
<b>End Semester Examination</b>	<b>35</b>
<b>TA</b>	<b>25 (Attendance (10), Mini-project/Assignment (15))</b>
<b>Total</b>	<b>100</b>

**Project based learning:** Each student in a group of 3-4 will have to develop a mini project based on association mining, classification and clustering approaches. The students can choose any real-world application that requires some decision-making. The students have to implement the mini-project using any open-source programming language. Project development will enhance the knowledge and employability of the students in IT sector.

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

<b>1</b>	Han, Jiawei, Jian Pei, and Micheline Kamber. Data mining: concepts and techniques. Elsevier, 3rd edition ,2012
<b>2</b>	Kimball R. and Ross M ,The Data Warehouse Toolkit”, Wiley, 3rd edition,2013
<b>3</b>	Pujari, Arun K, Data mining techniques , Universities press, 3rd edition , 2013
<b>4</b>	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, second edition, 2019
<b>5</b>	Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data”, Morgan Kaufmann, Elsevier
<b>6</b>	Mitchell, Tom, and Machine Learning McGraw-Hill. "Edition." (1997).
<b>7</b>	Wittek, Peter. Quantum machine learning: what quantum computing means to data mining. Academic Press, 2014.
<b>8</b>	Anahory S. and Murray D, Data Warehousing in the Real World, Addison- Wesley
<b>9</b>	Dunham, Margaret H. Data mining: Introductory and advanced topics. Pearson Education India, 2006.
<b>10</b>	Mattison R. ,Web Warehousing and Knowledge Management”, Tata McGraw- Hill.
<b>11</b>	David Hand, Heikki Mannila and Padhraic Smyth ,Principles of Data Mining,PHI
<b>12</b>	Transactions on Database Systems (ACM)
<b>13</b>	IEEE Transactions on Knowledge & Data Engineering
<b>14</b>	The VLDB Journal The International Journal on Very Large Data Bases

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	<b>17B1NCI731</b>	<b>Semester ODD</b> (specify Odd/Even)	<b>Semester VII Session 2022 -2023</b> Month from July 2022 to Dec 2022
<b>Course Name</b>	Machine Learning and Natural Language Processing		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. K. Vimal Kumar (J-62), Ms. Kritika Rani (J-128)	
	<b>Teacher(s)</b> (Alphabetically)	Dr. Himanshu Mittal, Dr. K. Vimal Kumar, Ms. Kritika Rani	

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Introduction	Introduction to Machine Learning & NLP, Challenges	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, CSG, PCFG	8
5.	Document classification	Supervised: Bayesian, Naive Bayes, N-gram model, sentiment analysis, text classification, Unsupervised: K-means, Expectation-Maximization (EM) algorithm, MaxEnt classifier	8
6.	Topic Modelling	Topic Modelling: Latent Dirichlet Allocation (LDA) and its Variants	2



7.	Applications	Document summarization, Co-referencing, noun phrase chunking, named entity recognition, co-reference resolution, parsing, information extraction, Machine Translation, Spell Correction, News Article Title Generation, Code Categorization, Question Answering (Eliza).	5
<b>Total number of Lectures</b>			<b>42</b>

**Evaluation Criteria**

Components	MaximumMarks
T1	20
T2	20
End Term Examination	35
TA	25
i) Attendance =07	
ii) Class Test, Quizzes, etc =07	
iii) Internal Assessment =05	
iv) Assignments in PBL mode =06	
<b>Total</b>	<b>100</b>

Project based learning: Each student in a group of 2-3 will apply Machine Learning and Natural Language Processing models to solve day-to-day problems. To make subject application based, the student applies ML & NLP technologies to the task of document summarization, information extraction, question answering, spell correction and many more. Applicability of part-of-speech tagging, parsing, document classification and topic modelling enhance the students' knowledge and help their employability into real-time application domains.

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

**Recommended Textbooks:** Author(s), Title, Edition, Publisher, Year of Publication etc.

1	Daniel Jurafsky and James H. Martin: Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Third Edition, Prentice Hall Series, 2000.
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**Recommended Reference Books:** Author(s), Title, Edition, Publisher, Year of Publication etc.

1	Pramod Singh, Machine Learning with PySpark: With Natural Language Processing and Recommender Systems, First Edition, Apress, 2018.
2	Joseph Olive, Caitlin Christianson, and John McCary (Eds.): Handbook of Natural Language Processing and Machine Translation: DARPA Global Autonomous Language Exploitation, 2011th Edition, Springer, 2011.
3	Steven Bird, Ewan Klein, and Edward Loper: Natural Language Processing with Python, O'Relly, 2009.
4	Philipp Koehn: Statistical Machine Translation, Cambridge University Press, 2009.
5	Sergei Nirenburg, Harold L. Somers, and Yorick A. Wilks, Readings in Machine Translation, MIT Press, 2003.
6	James Allen: Natural Language Understanding, Second Edition, Pearson, 2002.
7	Christopher D. Manning and Hinrich Schtze: Foundations of Statistical Natural Language Processing, MIT Press, 1999.

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	19B12CS426	<b>Semester ODD</b> <b>(specify Odd/Even)</b>	<b>Semester VII Session</b> 2022-2023 <b>Month from</b> July 2022- December 2023
<b>Course Name</b>	IoT Analytics		
<b>Credits</b>	3-0-0	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Chetna Dabas
	<b>Teacher(s)</b> <b>(Alphabetically)</b>	

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	INTRODUCTION TO DATA ANALYTICS FOR IoT	An introduction to Data Analytics for IoT – Structured Versus Unstructured Data – Data in Motion Versus Data at Rest – IoT Data Analytics Overview – IoT data Analytics Challenges	6
2.	MACHINE LEARNING FOR IoT ANALYTICS	Machine Learning for IoT – Machine Learning Overview – Machine learning and getting Intelligence from IoT Big Data – IoT Predictive Analytics - Geographical Concepts and Spatial Technology for IoT – Deep Learning techniques	10
3.	BIG DATA PLATFORM FOR IoT ANALYTICS	Big Data Platform for IoT Analytics - Massively parallel processing databases- Azure Data Lake and IoT Hub, 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	5

6.	WEB ENHANCED IoT	Design layers, design complexity- Web Enhanced Building Automation Systems – Smart City Control and Monitoring – Smart Environment Monitoring	6
		<b>Total</b>	<b>42</b>

**Evaluation Criteria**

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA( Tutorials regularity) 25 (Assignments and Attendance)	
	Attendance = 10 Internal assessment & Assignments in PBL mode = 15
<b>Total</b>	<b>100</b>

**Recommended Reading material:**

**Text Books**

1.	K David Hanes, Gonzalo Salguero, "IoT Fundamentals" Pearson, 2018.
2.	Andrew Minter, "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.

**Reference Books**

1.	Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", John Bates, 2015
2.	"Fog and Edge Computing : Principles and Paradigms" Rajkumar Buyya, Satish Narayana Srirama, Wiley
3.	Internet of Things Journal, IEEE

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	19B12CS423	<b>Semester ODD</b> (specify Odd/Even)	<b>Semester:VII Session 2022 -2023</b> <b>Month from July 2022-Dec 2023</b>
<b>Course Name</b>	Computing for Data Science		
<b>Credits</b>	3-1-0	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Megha Rathi
	<b>Teacher(s)</b> (Alphabetically)	Dr. Megha Rathi (J62), Ms. Anuradha Surolia (J128)

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
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	Evaluatestrategies for constructing models and can use different measures of model fit and performance to assess models.	Evaluate (Level 5)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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	7
3.	Computing techniques for Data Science	Regression, Mapping Problem to Machine Learning Task, Memorization Method, Generalized Additive Models, Time-Series Model, Predictive Modeling, Fuzzy C Means Clustering, Ensemble Techniques, Outlier Detection.	10-2
4.	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.	5

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	6
6.	Exploratory Data 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	5
7.	Data Science & Ethical Issues	Privacy, Security & Ethics, Next generation Data Scientist	2
<b>Total number of Lectures</b>			<b>42</b>

### Evaluation Criteria

#### Components

#### Maximum Marks

T1

20

T2

20

End Semester Examination

35

TA (Tutorials, regularity & Marco Assignments) 25 (Assignments & Attendance)

(Attendance and Tut Performance = 07

Internal assessment & Assignment in PBL mode = 18)

**Total**

**100**

**Project based learning:** Each student in a group of 3-4 will extract data from real-world domains using data streaming, web crawling, application programming interfaces (APIs), or from standard repositories that are globally recognized. For conducting application-based research, the students are encouraged to analyze social/political/financial/disease related data and apply data science techniques. Analysing the real-world data for extracting meaningful insights using statistical methods and data science algorithms, tools, and analytics.

### Recommended Reading material:

#### Text Books

- Haider, M. (2015). Getting Started with Data Science: Making Sense of Data with Analytics. IBM Press.
- Dietrich, D. (Ed.). (2015). Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley.
- Trevor, H., Robert, T., & JH, F. (2009). The Elements of Statistical Learning: Data Mining, Inference, And Prediction.

#### Reference Books

- Grus, J. (2015). Data Science from Scratch: First Principles with Python. O'Reilly Media, Inc.
- Taylor, J. K., & Cihon, C. (2004). Statistical Techniques for Data Analysis. Chapman and Hall/CRC.
- Shalev-Shwartz, S., & Ben-David, S. (2014). Understanding Machine Learning: From Theory to Algorithms. Cambridge University Press.
- Zumel, N., & Mount, J. (2014). Practical Data Science with R. Manning Publications Co..
- Saltz, J. S., & Stanton, J. M. (2017). An Introduction to Data Science. SAGE Publications.

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	19B12CS425	<b>Semester Odd</b> (specify Odd/Even)	<b>Semester VII Session</b> 2022-2023 <b>Month: from July to December 2022</b>
<b>Course Name</b>	Advanced Blockchain: A game theoretic view		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Naveen Kumar Gupta	
	<b>Teacher(s)</b> (Alphabetically)	Dr. Naveen Kumar Gupta	

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C430-4.1</b>	Define all the basic terminologies related to blockchain, game theory, nash equilibrium, pareto optimal solutions and decentralized applications.	Remember Level (Level 1)
<b>C430-4.2</b>	Understand the real fun in decentralized applications by understanding the use of game theories in deciding strategies by different nodes of decentralized applications like prisoner's dilemma, double auctioning, stackelberg algorithms etc.	Understand Level (Level 2)
<b>C430-4.3</b>	Identify the feasibility of applying different game theories in world distributed application scenarios.	Apply Level (Level 3)
<b>C430-4.4</b>	Analyze the change in the optimal solution and overall profit of the participating nodes by changing the theories in same and different applications.	Analyze Level (Level 4)
<b>C430-4.5</b>	Evaluation of performance, scalability, efficiency, throughput and state replication metrics in distributed applications using different game theories.	Evaluate Level (Level 5)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Introduction	Context, Requirements, and Application: History of Game theory, blockchain basics, and use cases for using game theory in blockchain based applications.	4
2.	GameTheory basics	Mixed-Strategy Nash Equilibrium, Pareto optimal solutions, Prisoner's dilemma, Computing Mixed Nash Equilibrium, Hardness Beyond 2x2 Games	4
3.	Game theory implementation	Maxmin Strategies, Correlated Equilibrium: Intuition, Dominated Strategies & Iterative Removal: An Application, Strictly Dominated Strategies & Iterative Removal	9
4.	Blockchain Basics	Blockchain use cases, bit coin, crypto currencies, distributed consensus, Directed acyclic graphs, permissioned and permission less networks	4
5.	Combining blockchain and game theory	Practical use cases for implementing game theory in blockchain to get the nash equilibrium in distributed network and to provide optimal solutions. Use case 1: Energy Trading.	8
6.	Further Use cases with practical implementation	Use case 2: VANET (Vehicular ad hoc network) Use Case 3: MANET( mobile ad hoc network) offloading problem solved	8
7.	Result comparison	Comparing the results of different strategies by modelling	5

	them on MATLAB	
<b>Total number of Lectures</b>		<b>42</b>
<b>Evaluation Criteria</b>		
<b>Components</b>	<b>Maximum Marks</b>	
T1	20	
T2	20	
End Semester Examination	35	
TA	25 (Attendance-10, Assignment / Quiz / PBL- 15)	
<b>Total</b>	<b>100</b>	

**Project based learning:** Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 2-4.

The course emphasized on the skill development for employability in software industry by engaging students on real life projects based on blockchain and game theory. Various activities are carried out to enhance the student's skills and real-life problem-solving using game theory. Some of them are study and application of distributed computing and game theory in various domains such as transportation, education, energy trading, etc.

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
<b>Text Books:</b>	
<b>1.</b>	<b>The Strategy of Conflict: With a New Preface by the Author (Paperback)</b>
<b>2.</b>	<b>Theory of Games and Economic Behavior (Paperback)</b>
<b>3.</b>	<b>Game Theory: A Very Short Introduction (Paperback)</b>
<b>Reference Books</b>	
<b>4.</b>	IEEE Transactions on vehicular technology
<b>5</b>	ACM Transactions on Blockchain and Game theory

### Course Description

<b>Subject Code</b>	19B12CS427	<b>Semester 2022</b>	<b>ODD</b>	<b>Semester VII Session 2022 – 23</b> <b>Month from July '22 to Dec '22</b>
<b>Subject Name</b>	Introduction to DevOps			
<b>Credits</b>	3	<b>Contact Hours</b>	3L+ 1DRS	
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Sulabh Tyagi		
	<b>Teacher(s)</b>	Dr. Sulabh Tyagi		
<b>Sections</b>	1			
<b>COURSE OUTCOMES</b>				<b>COGNITIVE LEVELS</b>
<b>C431-8.1</b>	Students will be able to understand the needs of Continuous integration, continuous delivery, continuous deployment and continuous monitoring.			Understand Level (Level 2)
<b>C431-8.2</b>	Students will be able to create pull and push requests using GIT and GIT Hub and also able to review the changes on GitHub			Create Level (Level 6)
<b>C431-8.3</b>	Students will be able to Write scripts for the creating pipeline and deploying the micro services for the Developed Application for the calculated load and response times.			Create Level (Level 6)
<b>C431-8.4</b>	Students will be able to write scripts for the measuring and loading the reports in KAFKA and Tableau for management view.			Evaluate Level (Level 5)
<b>Module No.</b>	<b>Subtitle of the Module</b>	<b>Topics in the module</b>		<b>No. of Lectures for the module</b>
1.	Introduction	Why DevOps? What is DevOps? DevOps Market Trends DevOps Engineer Skills DevOps Delivery Pipeline DevOps Ecosystem		8
2.	Git, CI, CD, CDep, CM	Creating and merging different Git Branches Git workflows Git cheat sheet What is Continuous Integration? What is Continuous Delivery? What is Continuous Deployment? What is Continuous		8



		Monitoring?	
3.	Jenkins	Introduction to Jenkins (With Architecture) 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 Chef & Ansible Chef Installation and Uses Ansible Installation Configuring Ansible Roles	8
5.	Containerization	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
<b>Total number of Lectures</b>			<b>42</b>

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 Attendance (05 Marks), Assignment/Quiz/Mini-project (20 Marks)
<b>Total</b>	<b>100</b>

Project based learning: Student shall be a part of a group of 5-6 students and will be require to create software projects using DevOps principles. The students are supposed to use advance tools like Chef, Ansible and Jenkins to implement automatic building and pipelining. Understanding how these building work them will enable their employability in software engineering sector.

Recommended Reading Material: Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books,

#### Text Books

1.	Practical DevOps by Joakim Verona , 2017, Packt publishing
2.	Ansible: Up and Running, Automating Configuration Management and Deployment the Easy Way by Lorin Hochstein, Rene Moser, 2017
3.	DevOps: A Software Architect's Perspective by Len Bass, Ingo Weber, Liming Zhu, 2018
4.	Accelerate, The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations by Nicole Forsgren, Jez Humble, Gene Kim, 2019

#### Reference Books

<b>5.</b>	Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale <b>by Jennifer Davis, Ryn Daniels by Orielly , 2017</b>
<b>6.</b>	Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation <b>by Jez Humble and David Farley, 2018</b>

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	21B12CS412	<b>Semester Odd</b> (Specify Odd/Even)	<b>Semester VII Session 2022 -2023</b> <b>Month: August 2022</b>
<b>Course Name</b>	Cryptography and its Applications		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Sangeeta Mittal, Dr. Rashmi Kushwah
	<b>Teacher(s)</b> (Alphabetically)	Dr. Sangeeta Mittal, Dr. Rashmi Kushwah, Dr. Himanshu Agrawal

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
C430-8.1	Define the principle of cryptography along with the categorization cryptography algorithms and its applicability into various allied areas.	Remember Level (Level 1)
C430-8.2	Understand the various cryptographic problems in distributed applications and its solutions such as cryptography, hashing, and digital signatures.	Understand Level (Level 2)
C430-8.3	Verify the feasibility and applicability of different cryptography and security algorithms in distributed applications.	Apply Level (Level 3)
C430-8.4	Perform the various cryptoanalysis algorithms like El Gamal, ECC, etc. for various distributed applications.	Analyze Level (Level 4)
C430-8.5	Evaluate the performance for various applications using various cryptographic algorithms and other related secure technologies.	Evaluate Level (Level 5)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Introduction to cryptography	Cryptography in modern era, Historical ciphers along with their cryptanalysis, rigorous versus heuristic approaches; principles of defining security and its adversarial models, Perfect Secrecy and Its Limitations.	4
2.	Categorization of cryptographic algorithms	Categories of cryptographic algorithms, Conceptual security, Introduction to public and private key cryptography and its applications.	3
3.	Symmetric cryptography models	Computational securities, Definition of secure encryption, How to construct secure encryption? Pseudo randomness, Construction of CPA-secure encryption, illustration of CCA attacks.	4
4.	Message authentication	Differentiate between secrecy and integrity, pseudorandom generators, DES, AES, Hash and MAC function, RC4, CBC-MAC, HMAC, Password hashing.	4
5.	Number theory and asymmetric key cryptography	Fundamental of group theory, Factorization, Primes and RSA, Cryptographic assumptions in cyclic groups, hash functions to collision resistance with discrete log, Introduction to public key encryption, Diffie-Hellman key exchange.	6
6.	Public key encryption	Public key encryption systems and its definitions, Hybrid model of encryption and KEM/DEM, El Gamal encryption, RSA: textbook encryption, attacks on textbook RSA, padded RSA;CCA secure RSA KEM.	5

7.	Elliptic Curve Cryptography (ECC) and Cryptoanalysis	Elliptic curve over finite fields, Elliptic curve cryptosystems (Diffie-Helman, El Gamal), Elliptic curve digital signatures (ECDSA, Bitcoin), Elliptic curve factorization, Pairing based systems and Review	4
8.	Analysis of various cryptographic signature	Digital signature definition and its applications, RSA signatures: textbook RSA, hashed RSA, security with ROM, Digital certificates, Certificates and public-key infrastructures, Proxy signature, Kerberos.	6
9.	Cryptographic evaluation techniques	Constructions of Pseudorandom Permutations (Block Ciphers) in Practice, Substitution-permutation and Feistel networks, DES and attacks on reduced-round versions, double-DES and triple-DES, Security of CTR, CCA attacks, Birthday attacks, The Random oracle model.	6
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Attendance(10) , Assignment/Quiz(5), PBL (10))	
<b>Total</b>		<b>100</b>	

**Project based learning:**

Students form group of size 2-3 members. Each group will identify several security issues in distributed applications in various thrust areas like healthcare, industrial, education, smart city, logistics, environment, governance and etc. Once problem has been identified, the group will analyze the problem and synthesize system based solutions to the identified problem. Each group will apply different cryptographic approaches such as symmetric key, hash function, asymmetric key, and etc. This approach will enhance skills of each student and increase the understanding of security issue in distributed applications. Moreover, candidate will gain the enough knowledge to provide the cryptographic solution to enhance the security of any organization/company. After this course, a student will able to undertake any work in this area in the industry or research.

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
<b>Text Books:</b>	
1.	DR Stinson, Paterson M. Cryptography: theory and practice. CRC press, 2018 Aug 14.
2.	Keith Martin. Everyday Cryptography: Fundamental Principles and Applications. Oxford University Press, 2017.
<b>References:</b>	
1	Cryptography: Portable technology offers boost for nuclear security, arms control applications
2.	Journal of Cryptography
3.	ACM Transactions on Information and system security
4.	IEEE Press Computer Security and Privacy
5	IEEE Transactions on Information Forensics and Security

## Detail Course Description

<b>Course Code</b>	21B12CS414	<b>Semester:ODD 2022 VII Sem</b>	<b>Semester: VII Session 2022 -2023 Month from Aug to Dec, 2022</b>
<b>Course Name</b>	<b>Smart System and IoT</b>		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. \PRAKASH KUMAR
	<b>Teacher(s) (Alphabetically)</b>	Dr. PRAKASH KUMAR

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C431-6.1</b>	Understanding IoT and smart sensors systems and its various applications.	Understand (level 2)
<b>C431-6.2</b>	Study of different sensors, its working principle for different applications.	Understand (level 2)
<b>C431-6.3</b>	Architectural design of smart system and its different components.	Analyze (level 4)
<b>C431-6.4</b>	Design challenges of different smart system application including security and self-health diagnostics capabilities.	Evaluate (level 5)
<b>C431-6.5</b>	Application of smart manufacturing processes and Industry 4.0 in smart factories.	Apply (level 3)
<b>C431-6.6</b>	Design and development of a smart system prototype for real-life problem.	Create (level 6)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Modules</b>	<b>No of Lectures</b>
1.	<b>Introduction to Smart Sensor and IoT</b>	Introduction:IoT, Smart Sensors, Measuring and Monitoring Environmental Condition, Different types of Smart Systems and its various application field using IoT.	4
2.	<b>Different Sensors and its characteristics</b>	Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications; Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc. Important Characteristics of Sensors: Static and Dynamic.	4
3.	<b>Design of smart sensors</b>	Importance and need to embrace the Smart Sensors, Architecture of Smart Sensors: Important components, their features. Interfacing Circuit for Smart Sensors and its Challenges.	4
4.	<b>Smart Home and Cities</b>	Benefit from the IoT to improve energy efficiency, security and convenience, Introduction of intelligent and connected devices. Smart Metering of Gas, Water, Electricity, Kitchen appliances, Smart Grid, Smart Traffic Management systems.	4
5.	<b>Smart Health care system</b>	Aging population,Challenges in digital health-care adoption, Health-care environment,Electronic Health Record (EHR) systems, Connected Healthcare system, Smart Health using Smart Phones, Health Monitoring Equipment and Sensors, Security and Privacy issues in IoT Protocol, Big Data for Health	4

		Management System.	
6.	<b>Smart Transportation system</b>	Introduction to Intelligent Transportation Systems (ITS), Broad categories: Public infrastructure and the Automotive industry. Smart Transportation: Car Navigation, Traffic signal control systems, Automatic number plate recognition, Speed cameras, Management, Efficiency, and Safety.Challenges: Security, Environmental Considerations, Supply Chain Resiliency, Power Consumption and Responsible Data Management.SMART Dispatch System case study.	3
7.	<b>Smart Wearable System</b>	Smart Wearable: health, activity, mobility, and mental status for both indoors and outdoors environment. Physiological sensor systems, Mobility Measurement System Designs: IoT based Wireless protocols. Real-Time decision support processing for disease prevention, symptom detection, and diagnosis. Challenges in design of wearable devices: flexible, lightweight, self-powered, miniaturized and self-healing materials.	3
8.	<b>Smart Agricultural System</b>	Precise Farming and Smart Farming, IoT components for Smart Farming: sensors, drones and robots. Suitable crops and water requirements for optimization using Smart Farming, Satellite imagery detects for pest and disease, Field Data analysis for profits, yields and patterns.	4
9.	<b>Smart Factory</b>	Smart Manufacturing Processes and Industry 4.0- Three Dimensions: (1) Demand Driven and Integrated Supply Chains; (2) Dynamically Optimized Manufacturing Enterprises; (3) Real Time, Sustainable Resource Management. Smart Design/Fabrication - Digital Tools, Product Representation and Exchange Technologies and Standards, Agile (Additive) Manufacturing Systems and Standards. Mass Customization, Smart Machine Tools, Robotics and Automation (perception, manipulation, mobility, autonomy), Smart Perception – Sensor networks and Devices.	6
10.	<b>Designing and prototyping a Smart System</b>	Design and development of a prototype for the above discussed smart system application using IoT, Characteristics of the design: low cost, user-friendly interface, scalable and reliable. Hardware and software co-design, basic requirements of prototype demonstration.	6

**Evaluation Criteria**

<b>Components</b>	<b>Maximum Marks</b>
Tes-1	20
Test-2	20
End Term Exam	35
Attendance	10
Assignment	7.5
Project Based Assessment	7.5 (Project Based Learning)
<b>Total</b>	<b>100</b>

Project Based Learning: A group of 4-5 students are to be formed. Each group shall design and develop IoT based Smart system device. These projects may involve software and hardware components and tools. They may also use certain simulation tools related to IoT and smart systems. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
<b>Text Books</b>	
1.	Advances in Modern Sensors; Physics, design, simulation and applications by Sinha, G, R, IOP (Institute of Physics Publishing), 2020
2.	Internet of Things: Architecture and Design Principles, Raj Kamal, McGrawHill. 2017
3.	Jan Ho"ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.
<b>Reference Books</b>	
4.	ArshdeepBahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
5.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", CISCO Press, 2017.
6.	<a href="https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet">https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet</a>
7.	<a href="https://www.emerald.com/insight/content/doi/10.1108/PRR-08-2019-0027/full/html">https://www.emerald.com/insight/content/doi/10.1108/PRR-08-2019-0027/full/html</a>
8.	<a href="https://www.digi.com/blog/post/introduction-to-smart-transportation-benefits">https://www.digi.com/blog/post/introduction-to-smart-transportation-benefits</a>
9.	<a href="https://nodered.org/docs/getting-started">https://nodered.org/docs/getting-started</a>
10.	<a href="https://www.arduino.cc/en/Tutorial/HomePage">https://www.arduino.cc/en/Tutorial/HomePage</a>
11.	<a href="https://www.raspberrypi.org/documentation/">https://www.raspberrypi.org/documentation/</a>

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Subject Code</b>	21B12CS415	<b>Semester:</b> (specify Odd/Even): Even	<b>Semester: 7th Session:</b> 2022-23 <b>Month:</b> August to Dec
<b>Subject Name</b>	Secure Design of Software Systems		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Sulabh Tyagi(J62) & Ashish Kumar (J128)
	<b>Teacher(s) (Alphabetically)</b>	Ashish Kumar , Dr. Sulabh Tyagi,

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
C431-13.1	Understand and articulate the implementation of secure practices in the software development lifecycle (SDLC).	Understand (level 2)
C431-13.2	Apply secure coding practices for improving the security and robustness of programs.	Apply (level 3)
C431-13.3	Apply tools to discover security problems and perform penetration testing of the software.	Apply (level 3)
C431-13.4	Perform security audit of databases to identify vulnerabilities.	Apply (level 3)
C431-13.5	Understand the various methods of invading data privacy.	Understand (level 2)

<b>Module No.</b>	<b>Subtitle of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>	<b>CO Mapping</b>
<b>1.</b>	Security of a software	Introduction, the problem, Software Assurance and Software Security, Asset, Vulnerability, Threat, Risk, Threats to software security, Sources of software insecurity, What Makes Software Secure: Properties of Secure Software.	3	C431-13.1
<b>2.</b>	Requirement engineering for secure software	Secure Development Lifecycle, The SQUARE process Model, Requirements elicitation and prioritization	3	C431-13.1
<b>3.</b>	Secure Design	Threat Modeling, Dataflow Diagram (DFD), Threat Tree (Attack Tree), STRIDE, DREAD, software security practices for architecture and design: architectural risk analysis, software security knowledge for architecture and design: security principles and guidelines.	7	C431-13.2
<b>4.</b>	Secure Coding	Integer Overflows/underflows, Buffer Overflow, format string vulnerability, Beware of (escape characters, reserved words, delimiters and commands) attacks and defense,	5	C431-13.2
<b>5.</b>	Security Testing	Static Analysis, Penetration Testing, Fuzz Testing, Code Auditing, Developers guidelines and Checklist, Security Review, Attack Surface review.	6	C431-13.3, C431-13.4



6.	Database Security and Auditing	Access control, Privileges, roles, Access Control Models, Design and Implementation of Discretionary Access Control, Role Based Access Control and Mandatory Access Control, Database Application Security models, SQL Injection, Virtual Private Databases, Database Auditing Models, Multilevel secure relational model, Watermarking relational databases, Security in distributed databases	10	C431-13.4
7.	Data Privacy and Metrics	Attacks on Privacy, Sanitization mechanisms, Privacy Definitions: k-anonymity, l-diversity, Protection against Background knowledge, Differential Privacy, Data anonymization, Anonymization operations: Generalization, Suppression, Anatomization, Permutation, Bucketization, Perturbation, Minimal distortion, Discernibility metric, Distinctive attribute.	8	C431-13.5
<b>Total number of Lectures</b>			<b>42</b>	
<b>Evaluation Criteria</b>				
<b>Components</b>		<b>Maximum Marks</b>		
T1		20		
T2		20		
End Semester Examination		35		
TA		25 (Attendance (10), Assignment/ Mini-Project/ Tutorial/ Quiz (15))		
<b>Total</b>		<b>100</b>		

**Project based learning:** Each student will make an application using any technologies (either single or in combination). Students will be required to develop a secure application while following secure software development practices and having countermeasures implemented against injection attacks, buffer overflows, etc and also maintain database security.

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
	<b>Text Books</b>
1	Robert C. Seacord: <i>Secure Coding in C and C++</i> , 2 <sup>nd</sup> Edition, SEI series in software engineering, 2013.
2	Adam Shostack: <i>Threat Modeling: Designing for Security</i> , Wiley, 2014.
	<b>Reference Books</b>
1	Gary McGraw, Software security Building security IN, Addison-Wesley software security, 2006.
2	Julia H. Allen , Sean J. Barnum, Robert J. Ellison, Gary McGraw , Nancy R. Mead: Software Security Engineering: A Guide for Project Managers, SEI series, 2008.
3	Jason Grembi, Developing Secure Software, Cengage Learning, 2009.

### Detailed Syllabus

<b>Course Code</b>	21B12CS417	<b>Semester: Odd</b> (specify Odd/Even)	<b>Semester: VII Session: 2022-23</b> <b>Month from: July-Dec</b>
<b>Course Name</b>	Machine Learning and Big Data (C431-12)		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Ambalika Sarkar, Dr. Dharmveer Singh Rajpoot
	<b>Teacher(s)</b> (Alphabetically)	Ambalika Sarkar, Dr. Dharmveer Singh Rajpoot

<b>COURSE OUTCOMES:</b> At the end of the course, students will be able to		<b>COGNITIVE LEVELS</b>
<b>CO1</b>	Identify the characteristics of datasets and use of machine learning techniques	Understand Level (Level 2)
<b>CO2</b>	Demonstrate online learning methods for big data applications.	Apply Level (Level 3)
<b>CO3</b>	Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.	Apply Level (Level 3)
<b>CO4</b>	Implement parallel learning algorithms using OpenMP/ CUDA/ OpenCL.	Apply Level (Level 3)
<b>CO5</b>	Evaluate and validate different problems associated with big data characteristics for high dimensionality, and in scalability issues.	Evaluate (Level 5)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Introduction to ML and Big data	Representation of data and exploration. Modeling of machine learning techniques. Application of big data computing technologies.	4
2.	Machine learning techniques	Three phases of machine learning, types of learning, Support vector machine, Decision trees and Random forests. Deep learning.	6
3.	Online methods for linear and nonlinear models	Online linear learning, 2 <sup>nd</sup> order methods and analysis of convergence, LBGFS: BFGS and Limited Storage BFGS, Online learning for non-linear/non-convex models, Non-Convex Optimization in Machine Learning	6
4.	Big data computing environment	Hadoop; Map-reduce/All-reduce; Hadoop Distributed File System, map reduce, Linear Learning with All-Reduce	7
5.	Parallelization of learning algorithms	Introduction to parallel learning algorithms and implementation using OpenMP/ CUDA/ OpenCL.	7
6.	Scaling up machine learning-I	Inverted Indices & Predictive Indexing; Feature Hashing; Locally-sensitive Hashing & Linear Dimensionality Reduction; Nonlinear Dimensionality Reduction; Feature Learning; PCA, LDA, SVD.	6
7.	Scaling up machine learning-II	Handling Many Classes, class embedding; Active Learning; Concepts, Scenarios, Clustering based active learning, Semi-supervised active learning, Exploration and Learning.	6

<b>Total number of Lectures</b>	<b>42</b>
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<b>Evaluation Criteria</b>	
<b>Components</b>	<b>Maximum Marks</b>
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance(10), Assignments/Mini-project/Tutorials/Quiz (15))
<b>Total</b>	<b>100</b>

Project based learning: Groups of 3-4 students will choose a project topic. They will use a suitable computing environment and machine learning technique to solve a real time big data problem. In a team, they will learn how to apply the concepts for problem solving in a meaningful way.

<b>Text Books:</b>	
1	Mining of Massive Datasets by Jure Leskovec, Anand Rajaraman, Jeff Ullman, 3 <sup>rd</sup> edition, Cambridge University Press, 2019 ( <a href="http://infolab.stanford.edu/~ullman/mmds/book0n.pdf">http://infolab.stanford.edu/~ullman/mmds/book0n.pdf</a> )
2	Data-Intensive Text Processing with MapReduce by Jimmy Lin and Chris Dyer, Morgan publishers, 2010. ( <a href="http://www.iro.umontreal.ca/~nie/IFT6255/Books/MapReduce.pdf">http://www.iro.umontreal.ca/~nie/IFT6255/Books/MapReduce.pdf</a> )

<b>Reference Books:</b>	
1	Machine Learning - A Complete Exploration of Highly Advanced Machine Learning Concepts, Best Practices and Techniques by Peter Bradley, Draft2digital, 25 June 2019
2	Guoqiang Zhong, Li-Na Wang, Xiao Ling, Junyu Dong, “An overview on data representation learning: From traditional feature learning to recent deep learning”, The Journal of Finance and Data Science, Vol. 2 (4), pp. 265-278, 2016, ISSN 2405-9188, <a href="https://doi.org/10.1016/j.jfds.2017.05.001">https://doi.org/10.1016/j.jfds.2017.05.001</a> .
3	Active Learning (Synthesis Lectures on Artificial Intelligence and Machine Learning) by Burr Settles, Morgan & Claypool Publishers, 30 July 2012

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b> <b>NBA Code</b>	<b>21B12CS418</b>	<b>Semester Odd</b>	<b>Semester VII Session 2022 -2023</b> <b>Month from July-Dec</b>
<b>Course Name</b>	Ethical Hacking and Prevention		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. P. Raghu Vamsi, Dr. Vartika Puri
	<b>Teacher(s)</b> <b>(Alphabetically)</b>	Dr. P. Raghu Vamsi, Dr. Vartika Puri

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C432-9.1</b>	Defined the need and basics of Ethical Hacking	Remember Level (Level 1)
<b>C432-9.2</b>	Enumerate the footprinting and information gathering techniques and their prevention	Understand Level (Level 2)
<b>C432-9.3</b>	Apply scanning tools for Operating System and Service Enumeration and prevention	Apply Level (Level 3)
<b>C432-9.4</b>	Implement and Analyze Network, System and Web Based exploitation Tools and Prevention	Analyze Level (Level 4)
<b>C432-9.5</b>	Evaluate Post Exploitation Effectiveness , Mobile hacking and Security	Evaluate Level (Level 5)
<b>C432-9.6</b>	Understand Legal Aspects of Ethical Hacking and write Penetration Testing Reports	Understand Level (Level 2)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1	Overview	Types of Hackers, Introduction to Ethical Hacking, What is legal and what is not, TCP/IP overview	3
2	Reconnaissance and Prevention	Active and Passive Footprinting, Web tools for Footprinting, Information Gathering by Social engineering, Social Engineer Toolkit (SET), Prevention of Information gathering	6
3	Scanning and Prevention	Pings and Ping Sweeps, Port Scanning, NMap, Vulnerability Scanning, Enumerating OS, OS Vulnerabilities scanning – NETBIOS, Tools for identifying Windows and Linux vulnerabilities, Web applications vulnerability scanning, Preventing Scanning	6
4	Exploitation – Network and System	Techniques for Gaining Access, Remote service access, password crackers, Sniffing the Network, Network Attacks – ARP, Session Hijacking and Denial of Service	6
5	Exploitation – Web Based	Basics of Web Hacking, Nikto, Spidering, WebScarab, Code injection, PDF Hacking	5
6	Prevention of Exploitation	Protecting against Malware, Best practices for Hardening Operating Systems, Web Filtering, Secure routers, Firewalls, Honeypots, Intrusion Detection Systems	3
7	Post Exploitation and Defense	Maintaining access with Backdoors, rootkits and meterpreter, privilege escalation , Penetrating the Internal Network Further, Defense - Recovery and Counter attack /	5

		Hackback	
8	Mobile Hacking and Security	Mobile platform attack vector, android vulnerabilities, jailbreaking iOS, windows phone vulnerabilities, mobile security guidelines, and tools	3
9	Pentesting Report	Various types of penetration testing, security audit, vulnerability assessment, and penetration testing roadmap	3
10	Legal Aspects of Ethical Hacking	Code of Ethics, Legal frameworks, Security Research Exemption, Whistle Blowing, Security Activism	2
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 Attendance (10 Marks), Assignment/Quiz/Mini-project (15 Marks)	
<b>Total</b>		<b>100</b>	

Project based learning: Student shall be a part of a group of 4-5 students and will be required to model and simulate real life enterprise system and apply ethical hacking tools to launch, detect and mitigate the attack. The highlighted content can be used to choose project topics that help students evaluate and apply the knowledge gained. The goal for each project is to work on case studies similar to those that a professional security tester comes across.

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
<b>Text Books:</b>	
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
<b>Reference Books:</b>	
4.	Corey P. Schultz, Bob Perciancante, "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.
7.	Engbretson, Patrick. The basics of hacking and penetration testing: ethical hacking and penetration testing made easy. Elsevier, 2013.

### Advanced Statistical Methods (22B12MA411)

Univariate descriptive statistics, central limit theorem, Sampling Distribution, Time Series, Control Charts, Linear Regression, Least Squares Estimation, Normal Regression, Tests of hypothesis for regression coefficients and mean, random vectors, Covariances, Correlations matrices, Multivariate normal distribution, Tests of hypothesis: Tests on with Known and unknown (Hotelling  $T^2$  statistic) of a multivariate normal population, one way and two-way analysis of variance (ANOVA) (populations with equal variance), Wilk's test statistic.

#### Course Description

<b>Course Code</b>	22B12MA411	<b>Semester:</b> Odd	<b>Semester VII Session-2022-23</b> <b>Month from</b> Aug 2022 –Dec 2022
<b>Course Name</b>	Advanced Statistical Methods		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Shikha Pandey	
	<b>Teacher(s) (Alphabetically)</b>	Dr. Shikha Pandey	
<b>COURSE OUTCOMES</b>			<b>COGNITIVE LEVELS</b>
After pursuing the above mentioned course, the students will be able to:			
<b>C401-22.1</b>	apply univariate statistics in Time series, control charts.		Applying Level (C3)
<b>C401-22.2</b>	apply linear and normal regression to fit data.		Applying Level (C3)
<b>C401-22.3</b>	understand multivariate statistics related statistical measures.		Understanding Level (C2)
<b>C401-22.4</b>	apply hypothesis testing for mean and variance in multivariate data.		Applying Level (C3)
<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures</b>
1.	Univariate Statistics	Univariate descriptive statistics, central limit theorem, Sampling Distribution associated with normal population, Sampling distributions, (chi square, t, F and Z) and hypothesis tests, Time	12

		Series: Components, Measurement of trends by graphical method and method of semi averages, Techniques of statistical quality control, control charts for variables and attributes.	
2.	Regression analysis	Linear Regression, Least Squares Estimation, Normal Regression, Tests of hypothesis for regression coefficients and mean.	8
3.	Introduction to Multivariate Statistics	Introduction of random vectors, Descriptive Statistics, Covariances, Correlations matrices, <b>Multivariate normal distribution.</b>	10
4.	Multivariate Hypothesis Testing	<b>Tests of hypothesis: Tests on <math>\mu</math> with <math>\Sigma</math> Known and <math>\Sigma</math> unknown (Hotelling <math>T^2</math> statistic) of a multivariate normal population, one way and two- way analysis of variance (ANOVA) (populations with equal variance), Wilk's test statistic.</b>	12
<b>Total number of lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Quiz, Assignments)	
<b>Total</b>		<b>100</b>	
<b>Project based learning:</b> Students in groups will collect multivariate data and use it for hypothesis testing.			
<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)			
1.	<b>T. W. Anderson</b> , <i>Introduction to multivariate analysis</i> , John Wiley, 1984.		
2.	<b>Biswas and Srivastava</b> , <i>A Textbook, Mathematical Statistics</i> 1 <sup>st</sup> Edition, Narosa Publishing House, New Delhi, 2011.		
3.	<b>A. M. Kshirsagar</b> , <i>Multivariate analysis</i> , Marcel Dekker, 1983.		
4.	<b>R. A. Johnson and D. W. Wichern</b> , <i>Applied multivariate statistical analysis</i> , Prentice hall Inc., 1988.		
5.	<b>D. F. Morrison</b> , <i>Multivariate Statistical Methods</i> , McGraw Hill Co., 3 <sup>rd</sup> ed., 1990.		

6.	<b>W. K. Hardle and L. Simar</b> , <i>Applied Multivariate Statistical analysis</i> , Springer, New York, 2019.
7.	<b>Alvin C. Rencher</b> , <i>Methods of Multivariate Analysis</i> , A JOHN WILEY & SONS, INC. PUBLICATION, Newyork, 2001.

**CO-PO-PSO Mapping**

<b>Cos</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>P O 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>
<b>C401-22.1</b>	2	2	1									2		
<b>C401-22.2</b>	2	2	1									2		
<b>C401-22.3</b>	2	2	2									1		
<b>C401-22.4</b>	2	2	1									1		
<b>Avg</b>	<b>2</b>	<b>2</b>	<b>1.25</b>									<b>1.5</b>		



### Applied Numerical Methods (17B1NMA732)

Concept of round-off and truncation errors. Iterative methods to find roots of one or more nonlinear equations with their convergence, Interpolating polynomial, Lagrange formula with error, Formulae for equispaced points, Divided differences, Spline interpolation, Least square approximation, Approximation of derivatives, Newton-Cote's formulae, Gauss-Legendre quadrature formulae, Double integration, Gauss-elimination and LU-Decomposition Methods, Iterative methods: Jacobi and Gauss Seidel Methods and their convergence, Power's method for the largest eigen-value, Jacobi and Householder's methods for eigen-values of real symmetric matrices, Runge-Kutta and predictor corrector methods for IVPs, Finite difference methods for BVPs, Shooting methods, Numerical solutions of parabolic and elliptic partial differential equations by finite difference methods

#### Course Description

<b>Course Code</b>	17B1NMA732	<b>Semester - Odd (specify Odd/Even)</b>	<b>Semester VII Session 2022 -2023 Month from August 2022 – Dec 2022</b>
<b>Course Name</b>	Applied Numerical Methods		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Yogesh Gupta and Dr. Neha Ahlawat
	<b>Teacher(s) (Alphabetically)</b>	Dr. Neha Ahlawat, Dr. Pinkey Chauhan and Dr. Yogesh Gupta

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
After pursuing the above mentioned course, the students will be able to:		
<b>C401-8.1</b>	Solve a single and a system of non-linear equations and analyze the convergence of the methods.	Applying Level (C3)
<b>C401-8.2</b>	explain finite and divided difference formulae for numerical interpolation.	Understanding Level (C2)
<b>C401-8.3</b>	apply numerical differentiation and integration in engineering applications.	Applying Level (C3)
<b>C401-8.4</b>	solve a system of linear equations using direct and iterative methods with their applications in various engineering problems.	Applying Level (C3)
<b>C401-8.5</b>	Solve eigen-value and corresponding eigen-vector problem for a square matrix.	Analyzing Level (C4)
<b>C401-8.6</b>	evaluate the solutions of initial and boundary value problems using various numerical methods.	Evaluating Level (C5)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Roots of Non-linear Equations	Concept of round-off and truncation errors. Iterative methods to find roots of one or more nonlinear equations with their convergence	6
2.	Interpolation and Approximation	Interpolating polynomial, Lagrange formula with error, Formulae for equispaced points, Divided differences, Spline interpolation, Least square approximation	7
3.	Numerical Differentiation and integration	Approximation of derivatives, Newton-Cote's formulae, Gauss-Legendre quadrature formulae, Double integration	7
4.	Numerical Linear Algebra	Gauss-elimination and LU-Decomposition Methods, Iterative methods: Jacobi and Gauss Seidel Methods and their convergence, Power's method for the largest eigen-	10

		value, Jacobi and Householder's methods for eigen-values of real symmetric matrices	
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 by finite difference methods	12
<b>Total number of Lectures</b>			<b>42</b>

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
<b>Total</b>	<b>100</b>

**Project Based Learning:** Each student in a group of 4-6 will apply the concepts of numerical methods for the solution of ODE and PDE.

**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, 6 <sup>th</sup> Ed., Pearson Education, 1999.
2.	Conte, S.D. and De Boor, C., Elementary Numerical Analysis, 3 <sup>rd</sup> Ed., McGraw-Hill, 1980.
3.	Gupta, R.S., Elements of Numerical Analysis, 1 <sup>st</sup> Ed., Macmillan 2009.
4.	Jain, M.K., Iyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation 5 <sup>th</sup> Ed., New Age International, New Delhi, 2007.
5.	Smith, G.D., Numerical Solution of Partial Differential Equations, 2 <sup>nd</sup> Ed., Oxford, 1978.

#### 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	PSO 1	PSO2
C401-8.1	3	3	3	2								2		
C401-8.2	3	2	2	2								2		
C401-8.3	3	2	2	2								2		
C401-8.4	3	2	2	2								2		
C401-8.5	3	3	3	3								2		
C401-8.6	3	3	3	3								2		
<b>Avg.</b>	3	3	3	2								2		

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	15B19CI793	<b>Semester Odd</b> (specify Odd)	<b>Semester VII Session</b> 2022 -2023 <b>Month from July to Dec</b>
<b>Course Name</b>	Summer Training & Viva		NBA Code: C455
<b>Credits</b>	Qualifying	<b>Contact Hours</b>	6-8 Weeks Industrial Training

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	K Vimal Kumar
	<b>Teacher(s)</b> (Alphabetically)	ALL FACULTY

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C455.1</b>	Summarize the contemporary activities with respect to their module, and explored tools for hands-on in the respective project area	<b>Understand Level (Level 2)</b>
<b>C455.2</b>	Analyze industry requirements and work culture	<b>Analyze Level (Level 4)</b>
<b>C455.3</b>	Apply technical knowledge to construct computing-based solution with respect to the identified problem at industry/institute.	<b>Apply (Level 3)</b>
<b>C455.4</b>	Interpret and critically evaluate the solution for the problem.	<b>Analyze Level (Level 4)</b>
<b>C455.5</b>	Create written discourse for presentation of work done at industry/institute	<b>Understand Level (Level 2)</b>

**Evaluation Criteria**

The Industrial Training of students will be evaluated on the basis of Viva and Report. They will be graded either as satisfactory or unsatisfactory