Subject Code	15B1NCI738	Semester: Odd	Semester: VII Session: 2020- 2021
			Month from Aug 2020 to Dec 2020
Subject Name	Social Network Analysis		
Credits	3	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Somya Jain, Pulkit Mehndiratta
	Teacher(s) (Alphabetically)	Somya Jain, Pulkit Mehndiratta

COURSE OUTCOMES		COGNITIVE LEVEL
C430-7.1	Define social network growth models and their characteristics.	Remember level (Level 1)
C430-7.2	Compare and interpret social network structure, size and its connectivity pattern using degree distribution, clustering coefficient, centrality, motifs, density, etc.	Understand Level (Level 2)
C430-7.3	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)
C430-7.4	Discover community structure in complex network using statistical techniques like Newman Girvan, Clique Percolation Method, Ford Fulkerman etc.	Analyse Level (Level 4)
C430-7.5	Model the cascading/flow of information in social network for maximizing the cascade, locating the seed nodes and influential nodes.	Apply Level (Level 3)
C430-7.6	Develop secured social networks by applying mechanisms like K-anonymity, L-diversity, T-closeness, etc. to ensure privacy and security.	Apply Level (Level 3)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Concepts: how services such as Facebook, LinkedIn, Twitter, etc. are using SNA to understand their users and improve their functionality.	2
2.	Network Concept	Introduction: Graphs, Paths and components, Adjacency Matrices, Ways and Modes, Matrix Product, node degree, types of nodes and types of ties, actor atributes	4
3.	Random network models	Erdos-Renyi , Barabasi-Albert , Watts-Strogatz small-world model, shortest path, six degree of separation	5

4.	Social Network Visualization	Tools: Gephi, NetLogo, Pajek, EgoNet	2
5.	Characterizing whole network	Cohesion, reciprocity, Transitivity and clustering Coefficient, Triad census	2
6.	Network centrality	Undirected Non-valued networks: Degree, Eigenvector, betweeness.Directed Non-valued Networks: Degree, Eigenvector, closeness. Valued Networks,Negative tie Networks, subgroup: Cliques and groups	5
7.	Community Detection	clustering, community structure, modularity, overlapping communities	5
8.	Link Prediction	The Katz Score, Hitting & Commute Time, Rooted PageRank, SimRank, Predictors Summary, Meta-measures	5
9.	Information Diffusion	Cascading Behavior: Herd Behaviour, Information Cascade Model, Threshold Model, Cascade Maximization, Epidemic Modeling	5
10.	Security and Privacy in Social Network	Introduction, K-Anonymity, L-Diversity, Q-Anon, T- Closeness	6
		Total number of Lectures	**41**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Liu, Bing. Web data mining. Springer-Verlag Berlin Heidelberg, 2007.
2.	Chakrabarti, Soumen. Mining the Web: Discovering knowledge from hypertext data. Morgan Kaufmann, 2003.
3.	Scime, Anthony, ed. Web mining: applications and techniques. IGI Global, 2005.
4.	Hitzler, Pascal, Markus Krotzsch, and Sebastian Rudolph. Foundations of semantic web technologies. CRC Press, 2011.
5.	King, Andrew B. Website optimization. " O'Reilly Media, Inc.", 2008.
6.	Segaran, Toby. Programming collective intelligence: building smart web 2.0 applications. " O'Reilly Media, Inc.", 2007.
7.	Charu.C. Aggarwal, Social Network Data Analytics, Springer Science+Business Media, LLC 2011
8.	Easley, David, Jon Kleinberg. *Networks, Crowds, and Markets: Reasoning about a Highly Connected World.* New York, NY: Cambridge University Press, 2010.
9.	Jackson, Matthew O. *Social and Economic Networks*. Princeton, NJ: Princeton University Press, 2008

Detailed Syllabus

Course Code	15B19CI793	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020
Course Name	Summer Training & Viva		
Credits	2	**Contact Hours**	4

Faculty (Names)	Coordinator(s)	K Vimal Kumar
	Teacher(s) (Alphabetically)	ALL FACULTY

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

Evaluation Criteria

Components	Maximum Marks
Viva	100
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B29CI791	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020
Course Name	Major Project		
Credits	12	Contact Hours	…

Faculty (Names)	Coordinator(s)	Dr. Raju Pal, 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)

Evaluation Criteria

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

Detailed Syllabus

Course Code	15B29CI792	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Term Paper
Credits	4	Contact Hours	…

Faculty (Names)	Coordinator(s)	Indu Chawla, Himani Bansal
	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)

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**

Project based learning: Each student in a group of 2-3 will select an application that he wants to develop and will do a detailed background study around the area to have a sound knowledge. Understanding the literature enhances the student's knowledge about the application area and thus helps in enhancing their employability into software sector. The subject entails the presentation of the technical aspects they have covered while researching, thus enhancing their soft skills which is a mandate for employability.

Course Code	16B1NCI733	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020
Course Name	Data Compression Algorithms		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Shruti Jaiswal (JIIT-128), Dr. Tribhuwan Kumar Tewari (JIIT-62)
	Teacher(s) (Alphabetically)	Dr. Shruti Jaiswal, Dr. Tribhuwan Kumar Tewari

COURSE OUTCOMES		COGNITIVE LEVELS
C430-3.1	Explain and summarize theoretical and practical significance of various mathematical concepts of data compression	Understand Level (Level 2)
C430-3.2	Demonstrate lossless and lossy compression techniques for images, videos,audios, etc	Understand Level (Level 2)
C430-3.3	Applying different data compression algorithms for solving complex problems	Apply Level (Level 3)
C430-3.4	Analyze the techniques for compression of binary data, image, audio and video	Analyze Level (Level 4)
C430-3.5	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), Differential coding of audio, lossless predictive coding,	8

		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, Compression in machine learning approaches with some case study, DeepZip: Lossless Compression using Recurrent Networks	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), Quiz (10))
Total	**100**

Recommended Reading material:
Text Books

1.	Ze-Nian Li; Mark S Drew; Jiangchuan Liu (2014). Fundamentals of multimedia, Cham: *Springer*
2.	Sayood, Khalid (2017). Introduction to Data Compression. 5th edition. Elsevier, **ISBN:** 9780128097052
3.	Tatwawadi, K. (2018). Deepzip: Lossless compression using recurrent networks. *URL https://web. stanford. edu/class/cs224n/reports/2761006. pdf*.

Reference Books and Journals

1.	Salomon, David A Guide to Data Compression Methods. (London: Springer, 2001) [ISBN 0-387-95260-8].
2.	Wayner, Peter Compression Algorithms for Real Programmers. (London: Morgan Kaufmann, 2000) [ISBN 0-12-788774-1].
3.	Chapman, Nigel and Chapman, Jenny Digital Multimedia. (Chichester: John Wiley & Sons, 2000) [ISBN 0-471-98386-1].
4.	IEEE Transactions on Speech and Audio Processing, **Electronic ISSN:** 1558-2353 **Print ISSN:** 1063-6676 (This Transactions ceased publication in 2005. The current retitled publication is IEEE/ACM Transactions on Audio, Speech, and Language Processing.)
5.	Sculley, D., & Brodley, C. E. (2006, March). Compression and machine learning: A new perspective on feature space vectors. In *Data Compression Conference (DCC'06)* (pp. 332-341). IEEE

Course Code	16B1NHS831	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020
Course Name	Gender Studies		
Credits	3	Contact Hours	3-0-0

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

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 level (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 level (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 level (C4)
C401-19.4	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporary settings	Evaluate level (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 level (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 • Gender Division of Labor • Gender Stereotyping and Gender Discrimination	9
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	6
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 & Women Rights In India • From Women's Studies to Gender Studies: A Paradigm Shift • Gender Sensitization & Gender Inclusivity • Gender Studies & Media: Creating New Paradigms in Gender & Culture	9
		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	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)

Course Code	17B1NBT732	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

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

Course Code	17B1NBT733	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Stress: Biology, Behaviour and Management		
Credits	3	Contact Hours	3-0-0

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 techniques and	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 Psychological interventions; Developing Cognitive	HICs to be delivered in the modules 1-6

	therapeutic strategies	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

Course Code	17B1NCI731	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Machine Learning & Natural Language Processing

Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. K Vimal Kumar
	Teacher(s) (Alphabetically)	Dr. K Vimal Kumar

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.	Title of the Module	Topics in the Module	No. of Lectures for the module
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,	5

		parsing, information extraction, Machine Translation, Spell Correction, News Article Title Generation, Code Categorization, Question Answering (Eliza).		
		Total number of Lectures		**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
i) Attendance = 07	
ii) Class Test, Quizzes, etc = 07	
iii) Internal assessment = 05	
iv) Assignments in PBL mode = 06	
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)

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

1	Daniel Jurafsky and J. Martin: Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (third edition)

Recommended Reference Books: Author(s), Title, Edition, Publisher, Year of Publication etc.

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

Course Code	17B1NCI732	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Computer and Web Security

Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Sangeeta Mittal (62), Himanshu Agrawal (128)
	Teacher(s) (Alphabetically)	Dr. Sangeeta Mittal (62), Himanshu Agrawal (128)

COURSE OUTCOMES		COGNITIVE LEVELS
C430-5.1	Assessing computing system's threats and access control in Operating Systems	Understand level (Level-2)
C430-5.2	Explain Software Security Issues, their solutions along with cryptography	Understand level (Level-2)
C430-5.3	Evaluate various malware detection systems	Analyze level (Level-4)
C430-5.4	Identify client-side web access threats like cross site scripting and SQL injection	Apply level (Level-3)
C430-5.5	Apply mechanisms of correct Identification and Authentication of users of computing resources	Understand level (Level-2)
C430-5.6	Examine non-cryptographic network protocol vulnerabilities and their solutions	Analyze level (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 Attacks, Bots, Botnets	7

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(10) + Quiz(5) + Assignment(5))
Total	**100**

Text Books:

T1.	Stallings and Brown, *Computer Security: Principles and Practice, 3/e* (2014, Prentice Hall).
T2.	Paul van Oorschot, Computer Security and the Internet: Tools and Jewels (2020, Springer).
T3.	Wenliang Du, Computer Security: A Hands-on Approach (2017, self-published).

Reference Books:

R1.	Gollmann, *Computer Security, 3/e* (2011, Wiley).
R2.	Stamp, *Information Security: Principles and Practice, 2/e* (2011, Wiley).
R3.	Pfleeger and Pfleeger, *Security in Computing, 4/e* (2007, Prentice Hall).
R4.	Menezes, van Oorschot and Vanstone, *Handbook of Applied Cryptography* (CRC Press, 2001).
R5.	Kaufman, Perlman and Speciner, *Network Security: Private Communications in a Public World, second edition* (Prentice Hall, 2003).
R6.	Pachghare V. K. , Cryptography And Information Security (2015, PHI).

Subject Code	17B1NCI747	Semester: Odd	Semester: VII Session: 2020 - 21
			Month from Aug 2020 to Dec 2020
Subject Name	Cloud Computing		
Credits	4	Contact Hours	3-1-0

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

COURSE OUTCOMES		COGNITIVE LEVEL
C430-8.1	Understand various Deployment Models, Cloud Service Models, Essential Characteristics, Foundational Elements and Enablers, Cloud Architecture.	Understand Level (Level 2)
C430-8.2	Analyze various Virtualization Techniques, Virtual Machine Provisioning, Migration techniques and their performances in cloud environments.	Analyze Level (Level 4)
C430-8.3	Analyze the performances of resource management and scheduling techniques in 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)

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, System models for Distributed, Client Server Models, Peer to Peer Models, Next big thing: cloud computing, Cloud Computing, Pay-as-per-use Model, Enabling Technologies	2
2.	Introduction to Cloud Computing, Issues and Challenges	What's cloud computing, History of cloud computing, Correlation between distributed and Cloud Computing	1
		Deployment Models, Private, Public, Community, Hybrid, Service models, SaaS, PaaS, IaaS. Essential Characteristics, Foundational Elements and enablers of Cloud Model	2
		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
		Virtualization Technologies, Virtual Machine Monitors, Virtual Machines	1
		Virtualization Techniques, ISA Level virtualization, Hardware Abstraction level, OS level, Library Level, Application Level virtualization techniques.	2
		VM Provisioning, Cloud Resource Virtualization, Hardware support for Virtualization. Case Study. Open Source VMM	2
		Introduction to Intel Virtualization Technology (IVT), Intel IA-32 and Itanium Architectures, Challenges in the design of these architectures	2
		Addressing the challenges by VTx and VTi architectures. Root Mode and Non-root mode operations of VTx and VTi	2
5.	Energy Aware Computing in Cloud, Resource Management, Scheduling and Load Balancing techniques	Resource Management, Resource scheduling and load balancing techniques and their performance analysis.	4
		Energy Aware concepts and techniques, Energy Aware computations with DVFS.	4
6.	Cloud Simulation platforms and frameworks	Open Source Frameworks CloudSim, GridSim, iFogSim etc. VMs, Data Centers in Cloudsim and iFogSim environments	4
7.	Cloud Security	Current state of data in cloud and data security in cloud, Network level security, Data level security,	3
		Access management and control, Authentication in cloud computing	2
8.	Cloud computing and IoT	Introduction to Cloud and IoT platforms.	2
		Open Source Cloud and IoT integration	2
		Applications of Cloud and IoT for Sustainable developments	2
		Total number of lectures	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Assignments (5), Mini Project (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)
Text Books:
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. R. K. Buyya, J Broberg, Adnrzej Goscinski, "Cloud Computing: Principles and Paradighms", Wiley Publisher.
3 Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kauffman Publishers, Elsevier.
4 Tanenbaum, A.S, Marten, V. Steen, Distributed Systems : Principles and Paradigms, 2nd Edition, Prentice Hall .
5. Barrie Sosinsky, "Cloud Computing Bible" Wiley India Publishers, 2013.
6. Arshadeep Bagha, Vijay Madisetti, "Cloud Computing: A HandsOn Approach" University Press, 2014.
Reference Books and other Materials
1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.
2. Rich Uhlig, et. al., "Intel Virtualization Technology" IEEE Journal, 2005.
3. Shailendra Singh, "Cloud Computing" Oxford University Press, 2018.
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. "Virtualization Overview", White paper, VM Ware.
9. "Implementing Virtualization" White paper, Intel virtualization Technology, 2008
10. Tulloch, Mitch, Understanding Microsoft virtualization solutions: From the Desktop to Data Center, Microsoft Press.

Course Code	17B1NHS731	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Customer Relationship Management		
Credits	3	Contact Hours	3-0-0

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

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

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	CRM-The Strategic Imperatives	Introduction, CRM in Marketing and IT, CRM for Business Leadership, Criticality of customer relationships, Why businesses should adopt CRM, Implementing CRM.	3
2.	Conceptual Foundations of CRM, Building Customer Relationships	Evolution of CRM, Benefits, Schools of thought on CRM, Defining CRM. Customer Retention and Customer Acquisition, Customer Profitability is Skewed, Service Benefits of CRM, Transaction Marketing vs. Relationship Marketing, Relationship Building as a process, Bonding for Customer Relationships-Financial, Social, customization and Structural bonds, Ladder of Loyalty Zero Customer Defection, CRM Framework.	7
3.	Relationship Marketing and Economics of CRM	Internal and external relationships, Electronic Relationships, Operational, Analytical and Collaborative CRM, Market Share vs. Share of Customer, Customer Lifetime Value, and Activity based costing for CRM	6
4.	CRM in B2C ,B2B Markets , Customer Experience Management	CRM in Product and Service Markets, Case Studies, Characteristics of Business Markets, Participants in the business buying process, Key Account Management, Using KAM for Customer Segmentation, Customer Retention Strategy, KAM as a growth and Development Strategy, Customer Value Management in Business Markets,	7

		Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation. ***Dominos using different types of content to practice engagement	
5.	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. ** Exercise on online campaign management solutions	7
6.	Product offerings in the CRM Marketplace (Overv iew) 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
7.	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. * Excercise on Mckinsey's social media model	5
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.	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.

Course Code	17B1NMA732	Semester: Odd	Semester: VII Session: 2020-21
			Month from Aug 2020 to Dec 2020

Course Name	Applied Numerical Methods		

Credits	3		Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr Yogesh Gupta and Dr Neha Ahlawat
	Teacher(s) (Alphabetically)	Dr Yogesh Gupta, Dr Neha Ahlawat, Dr. Pankaj Srivastava

COURSE OUTCOMES		COGNITIVE LEVELS
C401-8.1	solve a single and a system of non-linear equations and analyze the convergence of the methods.	Apply Level (C2)
C401-8.2	explain finite and divided difference formulae for numerical interpolation.	Understand Level (C3)
C401-8.3	apply numerical differentiation and integration in engineering applications.	Apply Level (C3)
C401-8.4	solve a system of linear equations using direct and iterative methods with their applications in various engineering problems	Apply Level (C3)
C401-8.5	solve eigen-value and corresponding eigen- vector problem for a square matrix	Analyze Level (C4)
C401-8.6	evaluate the solutions of initial and boundary value problems using various numerical methods.	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Roots of Non-linear Equations	Concept of round-off and truncation errors. Iterative methods to find roots for one or more nonlinear equations with their convergence	6
2.	Interpolation and Approximation	Interpolating polynomial, Lagrange formula with error, Formulae for equi-spaced 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-value, Jacobi and Householder's methods for eigen-values of real symmetric matrices	10
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

		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, PBL)
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, 7th Ed., Pearson Education, 2004.
2.	**Conte, S.D. and deBoor, C.**, Elementary Numerical Analysis, 3rd Ed., McGraw-Hill, 1980.
3.	**Gupta, R.S.**, Elements of Numerical Analysis, 2nd Ed., Cambridge University Press, 2015.
4.	**Jain, M.K., Iyengar, S.R.K. and Jain, R.K.**, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International, New Delhi, 2014.
5.	**Smith, G.D.**, Numerical Solution of Partial Differential Equations, 2nd Ed., Oxford, 1978.

Course Code	17B1NPH732	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Nanoscience and Technology		
Credits	3	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Navendu Goswami
	Teacher(s) (Alphabetically)	Navendu Goswami

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

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

	Nanomaterials	nanoparticles, Quantum dot devices, Quantum well devices, High T_c nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS	
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

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

Course Code	**17B2NCI731**	Semester: Odd	**Semester:** VII **Session:** 2020-21
			Month from Aug 2020 to Dec 2020

Course Name	Computer Graphics		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Gaurav Kumar Nigam (J128) and Prashant Kaushik (J62)

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 modeling, 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	5
2.	Graphics Pipeline and Hardware	Display Unit, Frame buffer, DPU, GPU	4
3.	Data structures and algorithms for Raster Graphics	Line, circle, ellipse, polygon, Area filling; Rasterization algorithms, clipping, polygonal fill, others. Introduction to hidden surface removal	8
4.	Colors	Color perception, color models (RGB, CMY, HLS), color transformations. Color in OpenGL. RGB and Indexed color	5

5.	2D and 3D Planer and Curved objects	Data structures for modeling; Algorithms for Mesh generation, Clipping, 2D and 3D; Geometric Transformations, and so on; Geometric transformations: affine transformations (translation, rotation, scaling, shear), homogeneous coordinates, concatenation, current transformation and matrix stacks; Three dimensional graphics: classical three dimensional viewing, specifying views, affine transformation in 3D, projective transformations;	9
6.	Rendering and animation	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 pixel maps, texture mapping, compositing; Introduction to animation and key framing	8
7.	Procedural modeling	Fractals and particle systems	3
		Total number of Lectures	**42**

Evaluation Criteria	A. **Theory Examination** I. Test 1 (T1) II. Test 1 (T1) III. End Term (T3) B. **Internal** - including Assignments, Quizzes, attendance, etc **Total**	**Max. Marks** 20 20 35 25 100

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.	"Computer Graphics with OpenGL", D. Hearn & M. P. Baker, Prentice Hall, 2003
2.	Introduction to Computer Graphics", J.D. Foley, A. van Dam, S.K. Feiner, J.F. Hughes & R.L. Phillips, Addison Wesley, 1997
3.	Computer Graphics: Principles and Practice", J.D. Foley, A. van Dam, S.K. Feiner & J.F. Hughes, Addison Wesley, 1995
4.	Computer Graphics: A Programming Approach by Steven Harrington

Course Code	18B12CS434	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Ethical Hacking		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. P. Raghu Vamsi
	Teacher(s) (Alphabetically)	Dr. P. Raghu Vamsi and Mr. Prashant Kaushik

COURSE OUTCOMES		COGNITIVE LEVELS
C431-3.1	Define what is ethical hacking and penetration testing, and when and why penetration testing is required along with testing phases.	Remember Level (Level 1)
C431-3.2	Classify and outline the penetration testing phases and relate the phases to the specified context.	Understand Level (Level 2)
C431-3.3	Identify and analyze the stages a penetration tester requires to take in order to compromise a target system.	Apply Level (Level 3)
C431-3.4	Examine and implement tools and techniques to carry out a penetration testing.	Analyze Level (Level 4)
C431-3.5	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	Different types of webserver attacks, attack methodology, and countermeasures. Different types of web application attacks, web application hacking methodology, and countermeasures	3

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	4
15	Pen testing Report	Various types of penetration testing, security audit, vulnerability assessment, and penetration testing roadmap	2
		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)

Text Books

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.

Reference Books

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.

NPTEL Courses

https://nptel.ac.in/courses/106/105/106105217/

Course Code	18B12CS436	Semester: Odd	Semester: VII Session: 2020-2021
			Month from Aug 2020 to Dec 2020

Course Name	Software Construction

Credits	4	Contact Hours	3-1-0

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

COURSE OUTCOMES		COGNITIVE LEVELS
C431-6.1	Choose appropriate fundamental element of software construction for an actual software development.	Remember 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 Optimization and Tuning.	Apply Level (Level 3)
C431-6.5	Demonstrate use of software construction techniques like parameterization, debugging and tools for GUI builders, unit testing , profiling, performance analysis and slicing .	Understand 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 Tuning 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	6
7.	Concurrency, synchronization and serialization in code	Implementing concurrency and serialization in code	6

	Total number of Lectures	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA (Tutorials regularity & Marco Assignments) 25 (Assignments and Attendance)	
Attendance = 07	
Internal assessment & Assignments in PBL mode = 18	
Total	**100**

Recommended Reading material:

Text Books

1.	Clean Code Paperback – 1 January 2013 by Robert C Martin (Author) Pearson
2.	The Pragmatic Programmer Addison Wesley; 2 edition (13 September 2019)
3.	Refactoring: Improving the Design of Existing Code (Pearson Addison-Wesley Signature Series) Hardcover – 12 November 2018
4.	The Clean Coder Pearson Education (2013)
5.	Clean Architecture: A Craftsman's Guide to Software Structure and Design January 2017 by Robert C. Martin (Author)
6.	Java Concurrency in Practice Pearson Education India; First edition (29 September 2016)
7.	Effective JAVA Pearson Education; Second edition (29 September 2016)
8.	Mastering Concurrency Programming with Java 9, Second Edition January 2017 by Javier Fernandez Gonzalez (Author)

Reference Books

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

Course Code	18B12CS437	Semester: Odd	Semester: VII Session: 2020 - 2021
			Month from Aug 2020 to Dec 2020

Course Name	Large Scale Database Systems		

Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Indu Chawla
	Teacher(s) (Alphabetically)	Dr. Indu Chawla

COURSE OUTCOMES		COGNITIVE LEVELS
C430-1.1	Infer the background processes involved in queries and transactions, and explain how these impact on database operation and design	Understand level (Level 2)
C430-1.2	Explain the concept and challenge of big data and demonstrate the comparison of relational database systems with NoSQL databases	Understand level (Level 2)
C430-1.3	Compare and discover the suitability of appropriate large databases to manage, store, query, and analyze various form of big data	Analyze level (Level4)
C430-1.4	Apply techniques for data fragmentation, replication, and allocation to design a distributed or parallel database system	Apply Level (Level3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to large scale Databases	Review of database systems, modelling and query languages	2
2.	Query processing and Optimization	Query planning, evaluation and optimization	5
3.	Transaction processing	Transaction processing, Concurrency control techniques, ACID rules	4
4.	Overview of Big Data	Introduction to Big Data and the four dimensions of Big Data: volume, velocity, variety, veracity. Big data sources, types and applications, CAP Theorem (consistency, availability, partition tolerance), Using big data in businesses, Data visualization for data analysis	5
5.	Storage and Indexing	Data storage and indexing of massive databases in databases and data warehouses. Introduction to technologies for handling big data, NOSQL databases	7
6.	Basics of Hadoop	Introduction to Hadoop, Configuring a Hadoop Development Environment, HDFS Architecture, HDFS Programming Fundamentals, Analyzing big data with	5

		Hadoop, MapReduce Architecture, MapReduce Programming	
7.	Application-driven databases	Parallel and Distributed databases, Distributed Database Design, Architecture of Distributed DBMS	8
8.	Distributed and parallel Query Processing	Query Processing, Distributed Query Optimization, Parallel Query Processing and Optimization	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (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)

Text Books:

1.	Henry F Korth, Abraham Silberschatz, S. Sudurshan, Database system concepts, 5th Edition, McGraw-Hill
2.	Ramez Elmasri , Shamkant B. Navathe , Fundamentals of Database Systems, 4th Edition, Pearson Education
3.	Sadalage, P.J. & Foowlwer, M. 2013. NoSQL distilled: a brief guide to the emerging world of polygot persistence. Addison-Wesley
4.	White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.
5.	Zikopoulos, Paul, and Chris Eaton. Understanding big data: Analytics for enterprise class hadoop and streaming data. McGraw-Hill Osborne Media, 2011.
6.	Shashank Tiwari, Professional NoSQL, Wiley, 2011

Reference Books:

1.	Rick, Smolan, and Jennifer Erwitt. "The human face of big data." Against All Odds Production (2012).
2.	Prajapati, Vignesh. Big data analytics with R and Hadoop. Packt Publishing Ltd, 2013.
3.	Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking. " O'Reilly Media, Inc.", 2013.
4.	DeRoos, Dirk. Hadoop for dummies. John Wiley & Sons, 2014.
5.	Mayer-Schönberger, Viktor, and Kenneth Cukier. Big data: A revolution that will transform how we live, work, and think. Houghton Mifflin Harcourt, 2013.

Subject Code	18B12HS211	Semester: Odd	Semester: VII Session: 2020-2021
			Months: from Aug 2020 to Dec 2020
Subject Name	PSYCHOLOGY OF PERSONALITY		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Badri Bajaj	
	Teacher(s) (Alphabetically)	Dr. Badri Bajaj	

COURSE OUTCOMES		COGNITIVE LEVELS
C401-9.1	Demonstrate a basic understanding of concepts of personality	Understand level (Level 2)
C401-9.2	Apply the concepts of personality in day to day life	Apply level (Level 3)
C401-9.3	Examine the different theoretical perspectives and approaches of personality	Analyze level (Level 4)
C401-9.4	Develop solutions for handling problems and achieving goals using personality concepts, theories and approaches	Create level (Level 6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to the Psychology of Personality	Definition and perspectives, Approaches, Research methods	6
2.	Determinants of Psychology of Personality	Motivation and Emotion, Interior selves and interior worlds, Mental abilities	6
3.	Theories	Psychoanalytical Theory of Personality: Freud, Neo Freudians: Jung, Horney, Erikson	10
4.	Approaches	Trait Approach: Allport, Cattell, Biological Approach, Social learning, Humanistic approach	10
5.	Assessment of Personality	Interviews, Projective tests, Behavioral assessment, Personality inventories	10
		Total:	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Quiz, Oral Questions)
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.	Schultz, D. P., and Schultz, S. E., *Theories of personality*. Cengage Learning 11th Ed., 2016.
2.	Burger, Jerry M. *Personality: an introduction*. Cengage Learning, 10th Ed., Cengage Learning, 2019.
3.	Mayer, John D. *Personality: A systems approach*. Rowman & Littlefield, 2017.

Course Code	18B12HS412	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

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.	Apply 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 Analytics, Analytical Performance Management, Retention	10

		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.	Edwards and Edwards, Predictive HR Analytics. Mastering the HR Metric, Kogan Page, Limited, 2019
2.	Banerjee, Pandey and Gupta, Practical Applications of HR Analytics, Sage, 2019
3.	Bhattacharyya, HR Analytics: Understanding Theories and Applications, Sage, 2017
4.	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
5.	Guenole, Ferrar and Feinzig, The Power of People: How Successful Organizations Use Workforce Analytics To Improve Business Performance, First Edition, Pearson, 2017
6.	Sesil, Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing, Incentive and Improving Collaboration, Pearson, 2014

Course Code	19B12CS422	Semester: Odd	Semester: VII Session: 2020-2021 Month from Aug 2020 to Dec 2020
Course Name	Mathematical Foundations for Intelligent systems		
Credits	3-1-0	Contact Hours	4
Faculty (Names)	Coordinator(s)	Dr. Dhanalekshmi G	
	Teacher(s)	Dr. Archana Purwar, Dr. Dhanalekshmi G	

COURSE OUTCOMES		COGNITIVE LEVELS
C431-5.1	Explain the concepts of computing eigenvectors, vector spaces , manipulate linear transformation and various decomposition techniques, probability, entropy .	Understand 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.:	Understand Level (C2)
C431-5.3	Explain concepts of time series analysis, linear vector calculus, Multivariable Calculus, Multivariate Chain Rule Gradient Descent Methods	Understand 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 Algebra in intelligent systems	Introduction to linear algebra; Data 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	7

		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 (Assignments + Mini project + 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)

Text Books:

1.	Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. Mathematics for machine learning. Cambridge University Press, 2020.
2.	Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.
3.	Bishop, C. M.: Pattern Recognition and Machine Learning.
4.	Lecture Notes on Maths for Intelligent Systems Marc Toussaint
5.	Strang, Gilbert. *Introduction to Linear Algebra*. 4th ed. Wellesley-Cambridge Press, 2009. ISBN
6.	Multivariable Calculus with Applications Maria Shea Terrell and Peter Lax

	Reference Books:
1.	Mitchell, Tom M. "Machine learning." (1997).
2.	Bishop, Christopher M. Pattern recognition and machine learning. springer, 2006.
3.	Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. The elements of statistical learning: data mining, inference, and prediction. Springer Science & Business Media, 2009.
4.	Optimization for Machine Learning Suvrit Sra, Sebastian Nowozin and Stephen J. Wright
5.	Learning with Kernels by Scholkopf and Smola (2000)
6.	Duda, Hart, Stork: Pattern Classification.
7.	Principle and Theory for Data Mining and Machine Learning by Clark, Forkoue, Zhang (2009)

Course Code	19B12CS423	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Computing for Data Science		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Adwitiya Sinha
	Teacher(s) (Alphabetically)	Dr. Adwitiya Sinha, Dr. Megha Rathi

COURSE OUTCOMES		COGNITIVE LEVELS
C431-7.1	Make use of basic concepts, methods, and mathematics relevant to computational techniques for data science	Apply level (Level 3)
C431-7.2	Develop own statistical analyses and implement them with advanced statistical programming tools	Apply level (Level 3)
C431-7.3	Develop and apply advanced and associated computing techniques and technologies.	Apply level (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 (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 (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	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
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,	6

		Redundancy Test), Bias Variance Trade off, Cross Validation	
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	5
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 (Tutorials, regularity & Marco Assignments)	25 (Assignments & Attendance)

(**Attendance and Tut Performance = 07**
 Internal assessment & Assignment in PBL mode = 18)

Total	100

Recommended Reading material:

Text Books

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.

Reference Books

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.

Course Code	19B12CS424	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	Industrial Automation using Internet of Things		
Credits	4	Contact Hours	3-1-0

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

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.	IIoTTechnology for Smart Sensors, Robotics & Automation	IIoTTechnology 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)

Text Book:

1.	Architectural Design Principles For Industrial Internet of Things by Hasan Derhamy

Reference Books:

2.	"Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress)
3.	"Industrial Internet of Things: Cybermanufacturing 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.SudipMisra

Course Code	19B12CS426	Semester: Odd	Semester: VII Session: 2020-2021
			Month from Aug 2020 to Dec 2020

Course Name	IoT Analytics		
Credits	4	**Contact Hours**	3-1-0

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

COURSE OUTCOMES		COGNITIVE LEVELS
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)

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 Versus Unstructured Data – Data in Motion Versus Data at Rest – IoT Data Analytics Overview – IoT data Analytics Challenges	6
2.	Machine learning for IoTanalytics	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
		Total	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA(Tutorials regularity)	25

(Assignments and Attendance)
Attendance = 07
Internal assessment & Assignments in PBL mode = 18

Total	**100**

Recommended Reading material:
Text Books

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.

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

Course Code	19B12CS427	Semester: Odd	Semester: VII Session: 2020-21
			Month from Aug 2020 to Dec 2020
Course Name	Introduction to DevOps		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Sulabh Tyagi
	Teacher(s) (Alphabetically)	Shariq Murtza, Sulabh Tyagi

COURSE OUTCOMES		COGNITIVE LEVELS
C431-8.1	Students will be able to understand the needs of Continuous integration, continuous delivery, continuous deployment and continuous monitoring.	Understand Level (Level 2)
C431-8.2	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)
C431-8.3	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)
C431-8.4	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)

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,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 Monitoring?
			8

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

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

Course Code	20B12PH411	Semester: Odd	Semester: VII Session: 2020 -2021
			Month from Aug 2020 to Dec 2020

Course Name	SUPERCONDUCTING MATERIALS, MAGNETS AND DEVICES

Credits	3	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Dinesh Tripathi
	Teacher(s) (Alphabetically)	Dr. Dinesh Tripathi

COURSE OUTCOMES		COGNITIVE LEVELS
C401-13.1	Define unusual properties exhibited by superconducting materials and how these properties are important in the development of superconducting Devices.	Remember Level (Level 1)
C401-13.2	Explain the theories of superconductivity, the basic and operating parameters of superconductors, their classifications and design limitations for superconductor's applications-devices.	Understand Level (Level 2)
C401-13.3	Solve the various issues related to fabrication of superconducting wires, tapes, design of superconducting magnets and devices.	Apply Level (Level 3)
C401-13.4	Examine the potential use of low Tc and high Tc superconductors for designing both small and large scale applications.	Analyze Level (Level 4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic properties of Superconducting materials	Historical review, the state of zero resistance, Perfect Diamagnetism, Meissner effect, London's theory, Penetration depth, Concept of coherence length and origin of surface energy, Intermediate and mixed states, Critical currents and critical fields, Outlines of B-C-S theory, concept of energy gap, Levitation force of superconductors, Tunneling in superconductors: Gaiever tunneling and Josephson tunneling	10
2.	Classifications & synthesis of Superconducting materials	Type I and Type II superconductors, Classification of superconducting materials, Conventional superconductor: metals (Pb, Nb, Ti etc.), metal alloys (NbTi, Nb3Sn etc.) and Inter-metallic superconductors (MgB2); Non-conventional Superconductors: Oxide based superconductors (BSCCO, YBCO), iron pnictides superconductors, Fabrication of superconducting wires & tapes.	10
3.	Design of Superconducting magnet	Flux flow, Flux pinning, Pinning force, Magneto-thermal Instabilities in Type II superconductors, Flux Jumps, Stabilization Criterion: Cryostatic and dynamic stabilization, Manufacture of long length superconducting multifilamentary wires, Design and fabrication of superconducting magnets, Magnetic field calculations, current leads, Persistent switches, and superconducting magnet energization.	12

4.	Superconducti ng devices	Josephson junction in magnetic field, Superconducting Quantum Interference Devices (SQUIDS) and its applications, Superconductive Switches, Infrared detectors Superconducting energy storage system (SMES), Fault current limiters (SFCL), Maglev trains	8
		Total number of Lectures	**40**

Evaluation Criteria
Components   **Maximum Marks**   T1   20   T2   20   End Semester Examination   35   TA   25 (Assignment (5), Quiz (5), Attend. (10) and Class performance (5))   **Total**   **100**

	Recommended Reading material:
1.	Roseins & Rhodrih, Introduction to Superconductivity, 2nd Edition, Pergamon Press plc
2.	Vladimir Z. Kresin & Stuart A. Wolf, Fundamentals of Superconductivity, Springer Science & Business Media
3.	Williams, Applied Superconductivity , Academic press New York.
4.	M. N. Wilson, Superconducting Magnet Design (Monographs on Cryogenics), Clarendon Press, Oxford Science Publications