

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

<b>Subject Code</b>	15B1NCI738	<b>Semester: Odd</b>	<b>Semester: VII Session: 2021- 2022</b> <b>Month from Sep to Dec</b>
<b>Subject Name</b>	Social Network Analysis		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	1. Dr. Anuja Arora (JIIT 62) 2. Dr. Pulkit Mehndiratta (JIIT 128)
	<b>Teacher(s) (Alphabetically)</b>	3. Dr. Anuja Arora, Dr. Pulkit Mehndiratta

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C430-7.1</b>	Define social network growth models and their characteristics.	Remember level (Level 1)
<b>C430-7.2</b>	Compare and interpret social network structure, size and its connectivity pattern using degree distribution, clustering coefficient, centrality, motifs, density, etc.	Understand Level (Level 2)
<b>C430-7.3</b>	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)
<b>C430-7.4</b>	Discover community structure in complex network using statistical techniques like Newman Girvan, Clique Percolation Method, Ford Fulkerman etc.	Analyse Level (Level 4)
<b>C430-7.5</b>	Model the cascading/flow of information in social network for maximizing the cascade, locating the seed nodes and influential nodes.	Apply Level (Level 3)
<b>C430-7.6</b>	Develop secured social networks by applying mechanisms like K-anonymity, L-diversity, T-closeness, etc. to ensure privacy and security.	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>
<b>1.</b>	Introduction	Concepts: how services such as Facebook, LinkedIn, Twitter, etc. are using SNA to understand their users and improve their functionality.	2
<b>2.</b>	Network Concept	Introduction: Graphs, Paths and components, Adjacency Matrices, Ways and Modes, Matrix Product, node degree, types of nodes and types of ties, actor attributes	4
<b>3.</b>	Random network models	Erdos-Renyi , Barabasi-Albert , Watts-Strogatz small-world model, shortest path, six degree of separation	5
<b>4.</b>	Social Network	Tools: Gephi, NetLogo, Pajek, EgoNet	2

	Visualization		
5.	Characterizing whole network	Cohesion, reciprocity, Transitivity and clustering Coefficient, Triad census, Assortativity Index, Rich Club Coefficient, Neighbourhood overlap	3
6.	Network centrality	Undirected Non-valued networks: Degree, Eigenvector, betweenness. 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
<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, Internal assessment & Assignments = 15)
<b>Total</b>	<b>100</b>

**Project Based Learning:** Students will form a group of 2-3 students. To design a problem statement, students read 4-5 research papers in which Social Network Analysis concepts have been used to handle social network applications problems. Theme and topic of project is chosen based on read research papers. Understanding usage of appropriate algorithm/techniques/model, implementation of the selected concepts, and evaluating its effectiveness based on performance measure help students to know the concept of applying the social network concepts in real world case scenarios.

**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. <i>Networks, Crowds, and Markets: Reasoning about a Highly Connected World</i> . New York, NY: Cambridge University Press, 2010.
9.	Jackson, Matthew O. <i>Social and Economic Networks</i> . Princeton, NJ: Princeton University Press, 2008

### Detailed Syllabus

<b>Course Code</b>	15B29CI791	<b>Semester: ODD</b>	<b>Semester: VII Session: 2021 -2022</b> <b>Month from Sep to Dec</b>
<b>Course Name</b>	Major Project Part – 1 (IT)		
<b>Credits</b>	4	<b>Contact Hours</b>	...

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Prashant Kaushik
	<b>Teacher(s) (Alphabetically)</b>	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>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>	15B29CI793	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021 -2022 <b>Month from</b> Sep to Dec
<b>Course Name</b>	Summer Training Viva		
<b>Credits</b>	Qualifying	<b>Contact Hours</b>	6-8 weeks Industrial Internship

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

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

**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

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

<b>Course Code</b>	16B1NBT531	<b>Semester Odd</b>	<b>Semester: VII    Session: 2021 -2022</b> <b>Month from June to Dec</b>
<b>Course Name</b>	Networks of Life		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	1. Dr. Shazia Haider
	<b>Teacher(s) (Alphabetically)</b>	1. Dr. Chakresh Jain 2. Dr. Shazia Haider

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C401-15.1</b>	Explain different type of networks	Understand Level (C2)
<b>C401-15.2</b>	Explain models, motifs and network analytics	Understand Level (C2)
<b>C401-15.3</b>	Apply networks to solve biological and social problems.	Apply Level (C3)
<b>C401-15.4</b>	Case studies on pathogen informatics, metabolic pathways	Analyse 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.	Network Sciences	Introduction to network sciences, Graph Theory, Random network, Scale Free Property, Various Models- Erdos Renyi, Barabasi-Albert etc. Centrality and Weighted Networks, Degree, Communities Identification, Robustness, Motifs and Evolving Networks.	18
2.	Computational Resources	Hands-on Cytoscape tool, Gephi, etc.	4
3.	Applications & advanced topics	Multi-Layered Networks, Spreading phenomenon, Temporal Networks, Networks in epidemics, networks in business, social networks, controlling networks, percolation, rewiring, machine learning in networks	10
4.	Miscellaneous	Case studies, projects, hands on workshop on advanced modules on python.	10
<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 (Assignments, MCQ, PBL)
<b>Total</b>	<b>100</b>
<b>Project Based Learning:</b> Students will choose any topic on Biological Network, Python language, Analysis	

tools and it's an application to solve the biological problem linked to a particular disease in a group of 4-5 students.

<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.	R. Cohen and S. Havlin, Complex Networks - Structure, Robustness and Function, Cambridge Univ Press, 2010.
2.	M.O. Jackson, Social and Economic Networks, Princeton Univ Press, 2008.
3.	A. Barrat, M. Barthelemy and A. Vespignani, Dynamical Processes on Complex Networks, Cambridge Univ Press, 2008.
4.	E. Kolaczyk, Statistical analysis of network data, Springer, 2009.
5.	S. Wasserman, K. Faust, Social Network Analysis: Methods and Applications, Cambridge Univ Press, 1994.
6.	P. Van Mieghem, Graph Spectra for Complex Networks, Cambridge Univ Press, 2011.
7.	R. Diestel, Graph Theory (4th edition), Springer, 2010.
8.	R.K.Ahuja and T.L.Magnanti, Network Flows: Theory, Algorithms, and Application , Pearson, 1993.
9.	Mark Newman, Albert-László Barabási, and Duncan J. Watts, The Structure and Dynamics of Networks, ISBN: 9780691113579, Princeton University press, 2006
10.	Albert-László Barabási, Network Science, Cambridge University Press in 2015.

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

<b>Course Code</b>	16B1NCI648	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-2022 <b>Month from</b> Aug to Dec
<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) (Alphabetically)</b>	Dr Devpriya Soni, Dr. Neetu Sardana

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C330-15.1</b>	Design and implement information retrieval systems for unstructured data.	Apply Level (Level 3)
<b>C330-15.2</b>	Apply query processing techniques for tolerant retrieval.	Apply Level (Level 3)
<b>C330-15.3</b>	Analyze Information retrieval models and their metrics.	Analyze Level (Level 4)
<b>C330-15.4</b>	Analyze the searching algorithms for Information Retrieval.	Analyze Level (Level 4)
<b>C330-15.5</b>	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).	
Total number of Lectures			42
Evaluation Criteria			
Components	MaximumMarks		
T1	20		
T2	20		
EndSemesterExamination	35		
TA	25 (Attendance = 07, Class Test, Quizzes, etc = 07, Internal assessment = 05, Assignments in PBL mode =06)		
Total	100		
<b>Project based learning:</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.			

<b>Recommended Reading material:</b>	
<b>Text Books</b>	
<b>1.</b>	Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, “An introduction to Information Retrieval”, 2013 Cambridge University Press UP.
<b>2.</b>	Rijsbergen C. J. 2012, “Information Retrieval”, 2 <sup>nd</sup> edition.
<b>Reference Books</b>	
<b>1.</b>	Salton, G. and McGill, M.J., “ <i>Introduction to Modern Information Retrieval</i> ”, Computer Series. McGraw-Hill, New York, NY.
<b>2.</b>	ACM Transaction on Internet Technology.

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

<b>Course Code</b>	16B1NHS831	<b>Semester:</b> Odd	<b>Semester:</b> VII Session 2021 -2022 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Gender Studies		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Ms. Shikha Kumari
	<b>Teacher(s) (Alphabetically)</b>	Ms. Shikha Kumari

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C401-19.1</b>	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)
<b>C401 - 19.2</b>	Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity and masculinity	Apply level (C3)
<b>C401- 19.3</b>	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)
<b>C401-19.4</b>	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporary settings	Evaluate level (C5)
<b>C401- 19.5</b>	Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies	Evaluate 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.	Introducing Gender Issues	<ul style="list-style-type: none"> <li>Sex and Gender</li> <li>Types of Gender</li> <li>Gender Roles</li> <li>Gender Division of Labor</li> <li>Gender Stereotyping and Gender Discrimination</li> </ul>	9
2.	Gender Perspectives of Body & Language	<ul style="list-style-type: none"> <li>Socio-Cultural Perspectives of body</li> <li>Body as a Site and Articulation of Power Relations</li> <li>Cultural Meaning of Female Body and Women's Lived Experiences</li> <li>The Other and Objectification</li> </ul>	6
3.	Social Construction of Femininity & Feminism	<ul style="list-style-type: none"> <li>Bio-Social Perspective of Gender</li> <li>Gender as Attributional Fact</li> <li>Feminine &amp; Feminist</li> <li>Major Theorists of Feminism Challenging Cultural Notions of Femininity</li> <li>Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism &amp; Cyber feminism</li> <li>Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ;Cultural Feminism &amp;</li> </ul>	9

		<div>Celebrating Womanhood</div> <ul style="list-style-type: none"><li>• Analysis of role women have played across cultures</li></ul>	
4.	Social Construction of Masculinity	<ul style="list-style-type: none"><li>• Definition and Understanding of Masculinities</li><li>• Sociology of Masculinity&amp; its Types</li><li>• Social Organization of Masculinity and Privileged Position of Masculinity</li><li>• Politics of Masculinity and Power</li><li>• Major Theorists of Masculinity</li><li>• Masculine Identities in Literature, Cinema &amp; Media.</li></ul>	9
5.	Gender Sensitization Empowerment &Gender Inclusivity	<ul style="list-style-type: none"><li>• Women &amp; Women Rights In India</li><li>• From Women’s Studies to Gender Studies: A Paradigm Shift</li><li>• Gender Sensitization &amp; Gender Inclusivity</li><li>• Gender Studies &amp; Media: Creating New Paradigms in Gender &amp; Culture</li></ul>	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	
<p><b>Project Based Learning</b> - Divide your life in different age brackets such as 0-5 years, 5-8 years, 8-12 years, 12-15 years, 15-18 years and 18-21 years and write about your experiences with gender. When was the first time you experienced your gender? What was/is the process of gender construction for you? How does different institutions such as family, schools, media, religion etc. has shaped your gender? What kind of differentiations discriminations (if any) you have faced on the basis of your gender. Also mention the differences you experienced in the second phase when you experienced the bodily changes? How has your gender identity is created during the course of your life? Please explain all these (not limited to these questions only) with the help of any gender theory that we have discussed in the course.</p>			

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

- 1 Davis K., et al, "*Handbook of Gender and Women's Studies*. London: Sage. (2006)
- 2 Helgeson, Vicki S., "*The Psychology of Gender*", Pearson(2012)
- 3 Friedan B., "*The Feminine Mystique*", Penguin. (1971/1992)
- 4 Debeauvoir S. , "*The Second Sex*", Vintage (1953/1997)
- 5 Wharton Amy S., "*The Sociology of Gender: An Introduction to Theory & Research*", Wiley-Blackwell (2005)
- 6 Pachauri G., "*Gender, School & Society*", R.Lall Publishers( 2013)
- 7 Connell R.W, "*Masculinities*", Cambridge: Polity. (1985)
- 8 MacInnes J., "*The End of Masculinity*". Buckingham: Open University Press. (1998)
- 9 Kaul A.& Singh M., "*New Paradigms for Gender Inclusivity*", PHI Pvt Ltd (2012)

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

<b>Course Code</b>	17B1NBT732	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-2022 <b>Month from</b> Sep to 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) (Alphabetically)</b>	Dr. Indira P. Sarethy, Dr. Shweta Dang

COURSE OUTCOMES		COGNITIVE LEVELS
<b>C401-14.1</b>	Explain healthcare market, drugs and devices, role of various stakeholders	Understand Level (C2)
<b>C401-14.2</b>	Apply related intellectual property laws and regulatory approvals for healthcare sector	Apply Level (C3)
<b>C401-14.3</b>	Analyze the various business models/ innovations in the healthcare industry	Analyze Level (C4)
<b>C401-14.4</b>	Compare economic aspects pertaining to the sector	Analyze Level (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 2	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 their roles, 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	Health to market innovations	4

	marketplace		
9	Healthcare informatics	e-health, collection of health data, data processing, evaluation, health information systems, case studies	2
<b>Total number of Lectures</b>			<b>42</b>

#### 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>

**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.

**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>Course Code</b>	17B1NBT733	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021 -2022 <b>Month from</b> Sept to Dec
<b>Course Name</b>	Stress: Biology, Behaviour and Management		
<b>Credits</b>	3	<b>Contact Hours</b>	4 (includes 1 hour /week for discussion)

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Vibha Gupta
	<b>Teacher(s) (Alphabetically)</b>	Vibha Gupta

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

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	HIC1 - DIY Strategies- Exercise and Health; HIC2 - Journal Writing/Music and Art Therapy; HIC3- Humor and Comic Relief; HIC4- Meditation/Mindfulness/Belly	HICs to be delivered in the

	management techniques and therapeutic strategies	Breathing/Visual Imagery/Progressive Muscle Relaxation Psychological interventions; Developing Cognitive Coping Skills; Creative Problem Solving (case studies);	modules 1-6  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	
Project based learning: To identify factors responsible for stress in the final year of B.Tech Engineering program and to develop a stress reducing intervention strategy.			

<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.	George Fink “Stress: Concepts, Cognition, Emotion, and Behavior: Handbook in Stress Series; Volume 1; Academic Press; 2016
2.	Jeanne Ricks “The Biology of Beating Stress”Kindle Edition; 2014
3.	Jerrold S. Greenberg “Comprehensive Stress Management” Tata McGraw-Hill Edition; Tenth Ed., 2009
4.	Brian Luke Seaward “Managing Stress: Principles and Strategies for Health and Well-Being” Sixth Ed., Jones and Bartlett Publishers, 2009
5.	Saundra E. Ciccarelli, and Glenn E. Meyer “Psychology” South Asian Edition; Published by Pearson Education (2008); ISBN 10:8131713873 / ISBN 13: 9788131713877

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

**Course Code**                      17B1NCI731                      **Semester:** ODD                      **Semester:** VII    **Session:** 2021 -2022  
**Month from** Sept to Dec

**Course Name**                      Machine Learning and Natural Language Processing

**Credits**    3    **Contact Hours**    3-0-0

**Faculty (Names)**    **Coordinator(s)**                      Dr. K. Vimal Kumar

**Teacher(s)**  
**(Alphabetically)**                      Dr. K. Vimal Kumar

**COURSE OUTCOMES**

**COGNITIVE LEVELS**

<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
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**Total number of Lectures      42**

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance =07, Class Test, Quizzes, etc=07, Internal Assessment =05, 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.

**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'Rely, 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.



4.	CRM in B2C, B2B Markets, Customer Experience Management	CRM in Product and Service Markets, Case Studies, Characteristics of Business Markets, Participants in the business buying process, Key Account Management, Using KAM for Customer Segmentation, Customer Retention Strategy, KAM as a growth and Development Strategy, Customer Value Management in Business Markets, Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation. ***Dominos using different types of content to practice engagement	7
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 (Overview) and CRM Roadmap	Evaluating Technological solutions for CRM, Comparison of Siebel, Oracle, MySAP.com and People Soft Enterprise solutions, Comparison of Talisma, Sales logix, Microsoft and Sales notes for small and medium enterprises, Defining a CRM strategy, CRM Implementation Roadmap, Developing a relationship orientation, Customer centric marketing and processes, Building organizational capabilities through internal marketing, Issues in implementing a technology solution for CRM.	7
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. * Exercise 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 (Project: Report, Viva, Class Participation)
<b>Total</b>	<b>100</b>

**Project Based Learning:** The project is to be done in group size of 4-5 members each. Student groups can choose an organization from one of the industry vertical like banking, IT, hospitality, telecom, airlines, logistics and consulting. Students need to study the CRM processes (internal CRM processes for improving employee productivity and external processes improving the organization-consumer interface) in the vertical/organization chosen. They need to develop a conceptual model to depict the processes. A questionnaire needs to be developed it can either be an employee-based survey or consumer-based survey. Based on data collection and analysis, CRM strategies have to be formulated, for better consumer segmentation/process improvement/productivity enhancement/ identification of customers with greater Customer Life Time Value/ Customer Retention Program. Strategies can be developed for Key Account Management and Campaign Management. This adds to the employability skills of customer management in an organization.

**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. Berry, Michael, J. A, Linoff, Gordon S., Datamining Techniques for Sales, Marketing and CRM, 3<sup>rd</sup> Edition, Wiley Publications, 2011.
2. Customer Relationship Management, Ed. Peelan Rob Beltman, 2<sup>nd</sup> Edition, Pearson, 2014.
3. Customer Relationship Management-A strategic perspective, G. Shainesh, Jagdish Sheth, Reprinted Macmillan Publishers India Limited, 21<sup>st</sup> edition 2017.
4. Customer Relationship Management Concepts and Technologies-Francis Buttle, 3<sup>rd</sup> Edition Taylor and Francis, 2015.
5. 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
6. 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.
7. Mukerjee, K., Customer Relationship Management-A Strategic approach to Marketing, 3<sup>rd</sup> Edition Prentice Hall of India, 2007.
8. 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.

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

<b>Course Code</b>	17B1NPH732	<b>Semester: ODD</b>	<b>Semester: VII Session: 2021 -2022</b> <b>Month from Sep to Dec</b>
<b>Course Name</b>	Nanoscience and Technology		
<b>Credits</b>	3	<b>Contact Hours</b>	3-1-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Navendu Goswami
	<b>Teacher(s) (Alphabetically)</b>	Navendu Goswami

<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	Remember level (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	Understand level (C2)
<b>C401-4.3</b>	Apply the concepts of Nanoscience for solving the theoretical and numerical problems	Apply level (C3)
<b>C401-4.4</b>	Determine the properties of nanomaterials through suitable characterization tools	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.	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 <sub>c</sub> 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	
<b>Project based learning:</b> 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.			

<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.

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

<b>Course Code</b>	18B12CS428	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-2022 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Introduction to Deep Learning		
<b>Credits</b>	03	<b>Contact Hours</b>	03
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Satish Chandra, Swati Gupta	
	<b>Teacher(s) (Alphabetically)</b>	Satish Chandra, Swati Gupta	

COURSE OUTCOMES		COGNITIVE LEVELS
<b>C434-3.1</b>	Identify and express the motivation behind and need of Deep Learning.	Understand level (Level-2)
<b>C434-3.2</b>	Comprehend the basic theory of learning, probability in learning, error minimization and regularization techniques.	Understand level (Level-2)
<b>C434-3.3</b>	Design and Model Convolution Neural Networks for Image recognition and Computer Vision.	Apply level (Level-3)
<b>C434-3.4</b>	Apply Recurrent Neural Networks and LSTM for temporal data	Apply level (Level-3)
<b>C434-3.5</b>	Assess the Deep Learning techniques on the basis of performance measures such as training speed, classification error, kappa coefficient, precision, recall and F-Measure.	Evaluate level (Level-5)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Course overview: Deep Learning Overview; Deep Learning successes; Deep Networks versus Shallow Networks;	02
2.	Mathematics for Machine Learning	Gradient descent, Linear Regression, Logistic Regression; Continuous and discrete distributions; Maximum likelihood estimation, Expectation Maximization; Principle Component Analysis;	06
3.	Neural Network Fundamentals	Neural networks: Feed-Forward Networks, MLP, Back propagation Networks; Activation Functions;	04
4.	Deep Neural Network-1	Deep learning strategies: GPU training, Regularization Techniques; Loss and Cost functions.	04
5.	Deep Neural Network-2	Convolutional neural networks: Image analysis with ANN, CNN;	05
6.	Deep Neural Network-3	CNN Architectures LeNet, AlexNet, GooleNet, VGG Net, ResNet: Comparative analysis	05
7.	RNN-1	Recurrent Neural Networks: Architecture and Application; Variants of RNN Architectures: LSTM, GRU, Bi- LSTM.	06
8.	RNN-2	Attention in DL, Self Attention, Soft vs Hard Attention, Global vs Local Attention,	06

		Sequence to sequence model: Encoder-Decoder, Transformer, Transformer XL	
9.	Unsupervised Deep learning	Unsupervised deep learning (Autoencoders)	04
Total Lectures			42

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
(Attendance = 05, Class Test, Quizzes, etc = 10, Assignments in PBL mode = 10)	
<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 Deep Learning Models. The datasets ranging from object detection problem to natural language processing will be provided for implementing the models. Project development and its presentation 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. in the IEEE format)

1.	Nikhil Buduma, Fundamentals of Deep Learning, Shroff Publishers , 2018
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press , 2017
3.	FRANÇOIS CHOLLET, Deep Learning with Python, Manning Publications, 2018



**Detailed syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	18B12HS211	<b>Semester: ODD</b>	<b>Semester: VII Session: 2021-2022</b> <b>Months: from Aug to Dec</b>
<b>Course Name</b>	Psychology of Personality		
<b>Credits</b>	3	<b>Contact Hours</b>	(3-0-0)
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Badri Bajaj	
	<b>Teacher(s) (Alphabetically)</b>	Dr. Badri Bajaj	

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C401-9.1</b>	Demonstrate a basic understanding of concepts of personality	Understand level (Level 2)
<b>C401-9.2</b>	Apply the concepts of personality in day to day life	Apply level (Level 3)
<b>C401-9.3</b>	Examine the different theoretical perspectives and approaches of personality	Analyze level (Level 4)
<b>C401-9.4</b>	Develop solutions for handling problems and achieving goals using personality concepts, theories and approaches	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>
<b>1.</b>	Introduction to the Psychology of Personality	Definition and perspectives, Approaches, Research methods	<b>6</b>
<b>2.</b>	Determinants of Psychology of Personality	Motivation and Emotion, Interior selves and interior worlds, Mental abilities	<b>6</b>
<b>3.</b>	Theories	Psychoanalytical Theory of Personality: Freud, Neo Freudians: Jung, Horney,	<b>10</b>
<b>4.</b>	Approaches	Trait Approach: Allport, Cattell, Biological Approach, Social learning, Humanistic	<b>10</b>
<b>5.</b>	Assessment of Personality	Interviews, Projective tests, Behavioral assessment, Personality inventories	<b>10</b>
<b>Total:</b>			<b>42</b>

**Evaluation Criteria**

<b>Components</b>	<b>Maximum Marks</b>
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Oral questions, Attendance)
<b>Total</b>	<b>100</b>

**Project based learning:** Students of Psychology of personality will choose any two theories from the syllabus and study these theories. Make group of 2-3 students. Write everyday applications of some aspects of these theories. Submit the report of the project through Google Classroom link. Make presentations in the

respective tutorial classes.

**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., <i>Theories of personality</i> , 11 <sup>th</sup> Ed, Cengage Learning, 2016.
2.	Feist, J., Feist, G.J., Roberts, T.Y., <i>Theories of personality</i> , 9 <sup>th</sup> Ed, McGraw Hill, 2018.
3.	Carver, C. S., & Scheier, M. F., <i>Perspectives on personality</i> , 8 <sup>th</sup> Ed Pearson education, 2017.
4.	Burger, Jerry M. <i>Personality: an introduction</i> . 10th Ed, Cengage Learning, 2019.
5.	Mayer, John D. <i>Personality: A systems approach</i> . 2 <sup>nd</sup> Ed., Rowman & Littlefield, 2017.

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

<b>Course Code</b>	18B12HS412	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021 -2022 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Human Resource Analytics		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr Kanupriya Misra Bakhru
	<b>Teacher(s) (Alphabetically)</b>	Dr Kanupriya Misra Bakhru Email id: kanupriya.misra@jiit.ac.in

COURSE OUTCOMES		COGNITIVE LEVELS
<b>C401-20.1</b>	Understand different analytical techniques used for solving HR related problems.	Understand Level (C2)
<b>C401-20.2</b>	Apply descriptive and predictive analysis techniques to understand trends and indicators in human resource data.	Applying Level (C3)
<b>C401-20.3</b>	Analyze key issues related to human resource management using analytical techniques.	Analyze Level (C4)
<b>C401-20.4</b>	Critically asses and evaluate the outputs obtained from analytical tools and recommend HR related decisions.	Evaluate Level (C5)
<b>C401-20.5</b>	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, Using Tableau.	10
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	12

		Analytics. Data Visualization and Storytelling using Tableau.	
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			44
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Project, Quiz)	
Total		100	
<b>Project Based Learning:</b> Students, in groups of 5-6, are required to select a contemporary topic of HR. Further students are required to select a sector from where they will collect the data. Data should be collected from at least 50 respondents from the chosen sector. The information can be collected with the help of an interview or some kind of questionnaire pertaining to the HR topic chosen. Analysis of the collected data should be done using SPSS software. Findings should be discussed and recommendations should be suggested.			

<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.	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

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

<b>Course Code</b>	19B12CS423	<b>Semester:Odd</b>	<b>Semester: VII Session: 2021 -2022</b> <b>Month from Sep to Dec</b>
<b>Course Name</b>	Computing for Data Science		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Adwitiya Sinha
	<b>Teacher(s) (Alphabetically)</b>	Dr. Adwitiya Sinha, Dr.Megha Rathi

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C431-7.1</b>	Make use of basic concepts, methods, and mathematics relevant to computational techniques for data science	Apply level (Level 3)
<b>C431-7.2</b>	Develop own statistical analyses and implement them with advanced statistical programming tools	Apply level (Level 3)
<b>C431-7.3</b>	Develop and apply advanced and associated computing techniques and technologies.	Apply level (Level 3)
<b>C431-7.4</b>	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)
<b>C431-7.5</b>	Evaluate strategies for constructing models and can use different measures of model fit and performance to assess models.	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 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,	5

		Tools & Techniques for unstructured data.	
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	25 (Attendance and Tut Performance = 07 Internal assessment & Assignment in PBL mode = 18)
<b>Total</b>	<b>100</b>

**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

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.

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

<b>Course Code</b>	19B12CS425	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-2022 <b>Month from</b> Sep to Dec
<b>Course Name</b>	Advanced Blockchain: A game theoretic view (CSE)		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Vikas Hassija
	<b>Teacher(s) (Alphabetically)</b>	Vikas Hassija

COURSE OUTCOMES		COGNITIVE LEVELS
<b>C430-9.1</b>	Define all the basic terminologies related to blockchain, game theory, nash equilibrium, pareto optimal solutions and decentralized applications.	Remember Level (Level 1)
<b>C430-9.2</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>C430-9.3</b>	Identify the feasibility of applying different game theories in world distributed application scenarios.	Apply Level (Level 3)
<b>C430-9.4</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>C430-9.5</b>	Evaluation of performance, scalability, efficiency, throughput and state replication metrics in distributed applications using different game theories.	Evaluate Level (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Context, Requirements, and Application: History of Game theory, blockchain basics, and use cases for using game theory in blockchain based applications.	3
2.	GameTheory basics	Mixed-Strategy Nash Equilibrium, Pareto optimal solutions, Prisoner's dilemma, Computing Mixed Nash Equilibrium , Hardness Beyond 2x2 Games	2
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	3
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.	10
6.	Further Use cases	Use case 2: VANET (Vehicular ad hoc network)	10

	with practical implementation	Use Case 3: MANET( mobile ad hoc network) offloading problem solved	
7.	Result comparison	Comparing the results of different strategies by modelling them on MATLAB	5
Total number of Lectures			42
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Attendance , Assignment and Quiz)	
<b>Total</b>		<b>100</b>	
<b>Project based learning:</b> 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 3-4.			
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)	
1.	The Strategy of Conflict: With a New Preface by the Author (Paperback)
2.	Theory of Games and Economic Behavior (Paperback)
3.	Game Theory: A Very Short Introduction (Paperback)
4.	IEEE Transactions on vehicular technology
5	ACM Transactions on Blockchain and Game theory

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

<b>Course Code</b>	19B12CS427	<b>Semester: Odd</b>	<b>Semester: VII Session: 2021 – 22</b> <b>Month from Sep to Dec</b>
<b>Course Name</b>	Introduction to DevOps		
<b>Credits</b>	3	<b>Contact Hours</b>	3L+ 1DRS

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

<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>Title of the Module</b>	<b>Topics in the module</b>	<b>No. of Lectures for the module</b>
<b>1.</b>	Introduction	Why DevOps? What is DevOps? DevOps Market Trends DevOps Engineer Skills DevOps Delivery Pipeline DevOps Ecosystem	8
<b>2.</b>	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
<b>3.</b>	Jenkins	Introduction to Jenkins (With Architecture)  Jenkins Management Adding a slave node to Jenkins Building Delivery Pipeline	8

		Pipeline as a Code Implementation of Jenkins in the Projects	
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 Attendance (05), Assignment/Quiz/Mini-project (20)	
Total		100	
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 works them will enable their employability in software engineering sector.			

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
<b>Text Books</b>	
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

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

<b>Course Code</b>	21B12CS411	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-2022 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Big Data with Hadoop and Spark		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr Shikha Mehta, Dr. Jaspal Kaur Saini
	<b>Teacher(s) (Alphabetically)</b>	Dr. Jaspal Kaur Saini, Dr Shikha Mehta

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C430-13.1</b>	Understand Big data challenges and need of Big data storage and computation tools.	Understand Level (Level 2)
<b>C430-13.2</b>	Apply Hadoop, HBase, MapReduce, Spark to solve big data problems.	Apply Level (Level 2)
<b>C430-13.3</b>	Analyze big data using Pig, Hive, Spark tools for solving real world problems.	Analyze Level (Level 4)
<b>C430-13.4</b>	Assess and apply Hadoop and Spark tools for big data analytics	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 Big Data And Hadoop	Digital Data Type, Introduction To Big Data, History Of Hadoop, Apache Hadoop And The Hadoop Ecosystem,	4
2.	Map Reduce	About Map Reduce, Analysing Data With Hadoop, Data Flow, Combiner Functions, Hadoop Streaming Using Python.	4
3	Hadoop Eco System – Pig	Introduction To Pig, Execution Modes Of Pig, Comparison Of Pig With Databases, Pig Latin, User Defined Functions, Data Processing Operators.	4
4	Hadoop Eco System – Hive	Apache Hive, Hive Sql Over Hadoop Mapreduce, Hive Shell, Hive Services, Hive Metastore, Comparison With Traditional Databases, Hiveql, Tables, Querying Data And User Defined Functions.	5
5	Hadoop Eco System- Hbase And Big Sql	Nosql DB Hbase, Hbase Architecture, Hbase Shell, Data Model, Hbase Versus RDBMS Big SQL Introduction	4
6	Apache Spark	Introduction Of Spark, Components, Hadoop Ecosystem Vs Spark, Running Scala In Spark Shell. Spark Web Ui	4
7	Scala	Scala Installation, Functional Programming, Programming	4

		With Scala, Logical Operator, Type Inference Classes, Functions In Scala,	
8	Spark Rdd	Resilient Distributed Datasets (RDD), RDD In Spark, RDD Operations	4
9	Spark Sql	Spark SQL Introduction, Dataframes, Spark SQL Architecture, Data Formats, Dataframe Using SQL Query, RDD Vs Dataframes VS Datasets	4
10	Sparkmllib	Spark Mllib Modeling Big Data, Analytics In Spark, ML: Supervised, Unsupervised, Spark Mllib Use For ML Modeling , Spark Graphx	5
<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, Class Test/Quiz = 10, Mini-Project = 5)
<b>Total</b>	<b>100</b>

**Project Based Learning:** Students will form a group of 3-4 students. Students will analyze a complex Big data computing problem and apply Hadoop Ecosystem design and programming using spark concept to provide effective solution to a Big Data Specific Problem Statement. Students will read 4-5 research papers/ Industrial Projects in which these concepts have been used to handle real scenario problems. Theme/topic of project is chosen based on studied literature. Understanding usage of appropriate Hadoop and Spark technique, then implementation of the project using selected technologies and evaluating its effectiveness will help students to know the concept of applying the big data technologies in real life case scenario.

#### Text Books Books

1.	Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012
2.	Karau, H., Konwinski, A., Wendell, P., & Zaharia, M. (2015). Learning spark: lightning-fast big data analysis. " O'Reilly Media, Inc."

#### Reference Books

1.	Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
2.	Chambers, B., & Zaharia, M. (2018). Spark: The definitive guide: Big data processing made simple. " O'Reilly Media, Inc."
3.	Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.`
5.	Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
6.	Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013
7.	Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012

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

<b>Course Code</b>	21B12CS412	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021 -2022 <b>Month from</b> Sep to Dec
<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. K. Rajalakshmi
	<b>Teacher(s) (Alphabetically)</b>	Dr. K. Rajalakshmi Ms. Pratishtha Verma

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

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to cryptography	Cryptography in modern era, Historical of 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,	5

		RSA: textbook encryption, attacks on textbook RSA, padded RSA;CCA secure RSA KEM.	
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 with n - k bit counter for messages to size 2k blocks with proof directly to the LR definition, CCA attacks, Birthday attacks, The Random oracle model.	6
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Attendance(10) , Assignment/Quiz(8), PBLmode(7))	
Total		100	
<b>Project based learning:</b> 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

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

<b>Course Code</b>	21B12CS413	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-22 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Fog and Edge Computing		
<b>Credits</b>	4	<b>Contact Hours</b>	3-1-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr Parmeet Kaur
	<b>Teacher(s) (Alphabetically)</b>	Dr Parmeet Kaur

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C431-11.1</b>	Define the technologies, architectures, entities and protocols, used for cloud and IoT systems	Remember Level (C1)
<b>C431-11.2</b>	Identify need, advantages, disadvantages, and application opportunities of fog and edge computing	Understand Level (C2)
<b>C431-11.3</b>	Describe the architecture, components and performance of fog and edge computing systems	Understand Level (C2)
<b>C431-11.4</b>	Examine the challenges and techniques of data analytics in fog and edge computing	Analyze Level (C4)
<b>C431-11.5</b>	Assess the application of fog and edge computing methods and protocols in IoT smart systems	Evaluate Level (C5)
<b>C431-11.6</b>	Demonstrate fog or edge scenario using simulation	Apply Level (C3)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the module</b>	<b>No. of Lectures for the module</b>
<b>1.</b>	Distributed Systems	Review of principles and concepts of Distributed Systems. Evolution of distributed systems: from mainframes to cloud to edge, Multi-tier distributed system architectures, Logical Time vs Physical Time	3
<b>2.</b>	Internet of Things	IoT Architecture & Technologies which include WSN (Wireless Sensor Networks) and IoT cloud computing, characteristics of IoT device platforms and products.	3
<b>3.</b>	Cloud computing	Introduction, Cloud Infrastructure Services, Cloud Computing characteristics of elasticity, multi-tenancy, on-demand access, ubiquitous access, usage metering, self-service capability, SLA-monitoring, Cloud Service Models/Types, Cloud deployment models, Mobile Cloud Computing, Virtual Machines, Containers	4
<b>4.</b>	Fog Computing	Definition, Characteristics, Application Scenarios, Issues, Fog Computing and Internet of Things, Pros and Cons, Need and Reasons for Fog Computing, Integrating IoT, FOG, Cloud- Benefits	6
<b>5.</b>	Fog Computing Architecture	Performance Evaluation Components, Metrics, Architecture-Modeling, Proximity Detection Protocols,	8

		FaaS	
6.	Data Management in Fog Computing	Fog Data Management, Big Data Analytics in the Fog, Security and Privacy Issues	6
7.	Edge Computing	Introduction, Origins of edge, Difference from fog, Edge helping low-end IoT nodes, Edge helping higher-capability mobile devices: mobile offloading, Edge helping the cloud, Data processing on the edge, Compare architectural design options regarding the tradeoff between computations in an IoT system, at edge or at cloud depending on application demands and resource constraints	6
8.	Case Studies	Fog Enhanced Smart Homes and buildings, Modeling and Simulation of Fog and Edge Computing Environments Using iFogSim Toolkit	6
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Attendance = 10, Assignment/Quiz/ Mini-Project: 15)	
Total		100	
<b>Project based learning:</b> Each student in a group of 4-5 will study a practical problem in fog and edge computing in detail along with its real-world applications. They will present it as a Case study or give a practical demonstration of the problem and its solution. This detailed study on distributed environment will help their employability into IT sector.			
<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)			
References			
1.	Buyya, Rajkumar, and Satish Narayana Srirama, eds. “Fog and edge computing: principles and paradigms”. John Wiley & Sons, 2019.		
2	Chang, Wei, and Jie Wu. "Fog/Edge Computing for Security, Privacy, and Applications."		
3.	Mahmud, R., Kotagiri, R., & Buyya, R. (2018). Fog computing: A taxonomy, survey and future directions. In Internet of Everything (pp. 103–130). Springer, Singapore		
4.	Ivan Stojmenovic, Sheng Wen,” The Fog Computing Paradigm: Scenarios and Security Issues” Proceedings of the 2014 Federated Conference on Computer Science and Information Systems pp. 1–8		
5.	Cao, Jie, Quan Zhang, and Weisong Shi. <i>Edge computing: a primer</i> . Springer International Publishing, 2018.		
6.	Mahmud, Redowan, and Rajkumar Buyya. "Modelling and simulation of fog and edge computing environments using iFogSim toolkit." <i>Fog and edge computing: Principles and paradigms</i> (2019): 1-35.		
7.	Dastjerdi, Amir Vahid, Harshit Gupta, Rodrigo N. Calheiros, Soumya K. Ghosh, and Rajkumar Buyya. "Fog computing: Principles, architectures, and applications." In <i>Internet of things</i> , pp. 61-75. Morgan Kaufmann, 2016.		
8.	Dastjerdi, Amir Vahid, and Rajkumar Buyya. "Fog computing: Helping the Internet of Things realize its potential." <i>Computer</i> 49, no. 8 (2016): 112-116.		
9.	Serpanos, Dimitrios, and Marilyn Wolf (2017). Internet of things (IoT) Systems: Architectures, Algorithms, Methodologies. Springer. DOI:https://doi.org/10.1007/978-3-319-69715-4		

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

<b>Course Code</b>	21B12CS415	<b>Semester:</b> Even	<b>Semester:</b> VII <b>Session:</b> 2021-22 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Secure Design of Software Systems		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Prof. Sandeep Kumar Singh, Dr. Shruti Jaiswal
	<b>Teacher(s) (Alphabetically)</b>	Prof. Sandeep Kumar Singh, Dr. Shruti Jaiswal

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

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	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
2.	Requirement engineering for secure software	Secure Development Lifecycle, The SQUARE process Model, Requirements elicitation and prioritization	3
3.	Secure Design	Threat Modelling, 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
4.	Secure Coding	Integer Overflows/underflows, Buffer Overflow, format string vulnerability, Beware of (escape characters, reserved words, delimiters and commands) attacks and defense,	5
5.	Security Testing	Static Analysis, Penetration Testing, Fuzz Testing, Code Auditing, Developers guidelines and Checklist, Security Review, Attack Surface review.	6
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,	10

		Security in distributed databases	
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
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Attendance (10), Assignment/ Mini-Project/ Tutorial/ Quiz (15))	
Total		100	
Project based learning: Each student will become well conversant to analyze a system and built its complete Threat Profile. They will become confident in using secure coding practices in the routine development tasks as well as specific projects. These aspects of the course will boost their employability skills.			

<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.	Julia H. Allen , Sean J. Barnum, Robert J. Ellison, Gary McGraw , Nancy R. Mead: <i>Software Security Engineering: A Guide for Project Managers</i> , SEI series, 2008.
3.	Julia H. Allen, <i>Software Security Engineering</i> ., Pearson Education
4.	Adam Shostack: <i>Threat Modeling: Designing for Security</i> , Wiley, 2014.
	<b>Reference Books</b>
1	Gary McGraw, <i>Software security Building security IN</i> , Addison-Wesley software security, 2006.
2	Jason Grembi, <i>Developing Secure Software</i> , Cengage Learning, 2009.

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

<b>Course Code</b>	21B12CS417	<b>Semester: Odd</b>	<b>Semester: VII      Session: 2021-22</b> <b>Month from Aug to Dec</b>
<b>Course Name</b>	Machine Learning and Big Data		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Ambalika Sarkar, Dr. Anuja Arora
	<b>Teacher(s) (Alphabetically)</b>	Ambalika Sarkar, Dr. Anuja Arora

<b>COURSE OUTCOMES:</b> At the end of the course, students will be able to		<b>COGNITIVE LEVELS</b>
<b>C431-12.1</b>	Identify the characteristics of datasets and use of machine learning techniques	Understand Level (Level 2)
<b>C431-12.2</b>	Demonstrate online learning methods for big data applications.	Apply Level (Level 3)
<b>C431-12.3</b>	Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.	Apply Level (Level 3)
<b>C431-12.4</b>	Implement parallel learning algorithms using OpenMP/ CUDA/ OpenCL.	Apply Level (Level 3)
<b>C431-12.5</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,	6

	Semi-supervised active learning, Exploration and Learning.	
<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), 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.

### Recommended Reading material:

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 Processingwith 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> )
3	Machine Learning - A Complete Exploration of Highly Advanced Machine Learning Concepts, Best Practices and Techniquesby Peter Bradley, Draft2digital, 25 June 2019
4	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> .
5	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: 2021 -2022</b> <b>Month from Aug to 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>	Amanpreet Kaur, Vartika Puri
	<b>Teacher(s)</b> <b>(Alphabetically)</b>	Amanpreet Kaur, 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>
<b>1</b>	Overview	Types of Hackers, Introduction to Ethical Hacking, What is legal and what is not, TCP/IP overview	3
<b>2</b>	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
<b>3</b>	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
<b>4</b>	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
<b>5</b>	Exploitation – Web Based	Basics of Web Hacking, Nikto, Spidering, WebScarab, Code injection, PDF Hacking	5
<b>6</b>	Prevention of Exploitation	Protecting against Malware, Best practices for Hardening Operating Systems, Web Filtering, Secure routers, Firewalls, Honeypots, Intrusion Detection Systems	3
<b>7</b>	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	LegalAspects of Ethical Hacking	Code of Ethics, Legal frameworks, Security Research Exemption, Whistle Blowing, Security Activism	2
Total number of Lectures			42

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

**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)	
1.	Sean-Philip Oriyano, "Certified Ethical Hacker Version 9 - Study Guide", EXAM 312-50, Sybex Wiely, 2016.
2.	Georgia Weidman, "Penetration testing A Hands-On Introduction to Hacking", No Scratch Press, 2014.
3.	Raphaël Hertzog, Jim O’Gorman, and Mati AharoniKali, "Linux Revealed Mastering the Penetration Testing Distribution", OFFSEC Press, 2017
4.	Corey P. Schultz, Bob Percianccante, "Kali Linux Cook Book", Second edition, Packet Publishing, 2017.
5.	Lee Allen, Tedi Heriyanto, Shakeel Ali, "Kali Linux – Assuring Security by Penetration Testing, Packet Publishing, 2014.
6.	Dejey, Murugan, “Cyber Forensics”, Oxoford University Press, 2018.
7.	Engebretson, Patrick. The basics of hacking and penetration testing: ethical hacking and penetration testing made easy. Elsevier, 2013.

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

<b>Course Code</b>	21B12EC413	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-22 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Solar Engineering		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Ruby Beniwal
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<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C402-37.1</b>	Outline the basic concepts of Solar Energy with recent scenario.	Understand Level (C2)
<b>C402-37.2</b>	Identify various techniques for Solar Engineering	Apply Level (C3)
<b>C402-37.3</b>	Innovative ideas for applications of Solar Energy in Electronics	Apply Level (C3)

<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.	Solar Basics	Introduction, Environmental Characteristics, Heat transfer concept, Heat Transfer coefficient, Optimization of Heat Losses, Thermal analysis and effect of environment with economic analysis	8
2.	Solar Engineering-I: Electrical Aspect	Solar Cell materials, Single crystal solar cell or solar grade, Types of Solar Energy Collectors, Performance of Solar Collectors, Photovoltaic Systems, Design and Modeling of Solar Systems, Solar Energy Analysis	12
3.	Solar Engineering-II: Thermal Aspect	Solar Thermal Power Systems, PVT air/water collectors performance, design and modeling	10
4.	Applications	Solar Water-Heating Systems, Solar Space Heating and Cooling, Industrial Process Heat, Solar Dryers, Solar Desalination Systems, and applications of Solar Energy in Electronics and communication engineering	12
<b>Total number of Lectures</b>			<b>42</b>

**Evaluation Criteria**

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

**Project based learning:** Students will review and prepare report on any one of the discussed applications of solar energy.

**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.	G.N. Tiwari, Solar Energy : fundamentals, Design, Modelling and applications. Narosa Publishing House, 2016.
2.	Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and applications. Prentice Hall of India, 2015
3.	James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley-IEEE Press, 2012.
4	Juan Bisquert, The Physics of Solar Cell, CRC Press, Taylor & Francis group, 2018

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

<b>Course Code:</b>	21B12HS411	<b>Semester:</b> Odd	<b>Semester:</b> VII <b>Session:</b> 2021-2022 <b>Month from</b> Aug to Dec
<b>Course Name</b>	Urban Sociology		
<b>Credits</b>	03	<b>Contact Hours</b>	<b>3-0-0</b>

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Prof. Alka Sharma
	<b>Teacher(s) (Alphabetically)</b>	Prof. Alka Sharma Dr. Priyanka Chhaparia

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C401-25.1</b>	Understand the concepts and theories of Urban Sociology	Understand Level (C2)
<b>C401-25.2</b>	Apply an analytical framework to understand the structural characteristics of cities students are residing in	Apply Level (C3)
<b>C401-25.3</b>	Analyze the role of agencies and actor in shaping the process of urbanisation	Analyse Level (C4)
<b>C401-25.4</b>	Evaluate the importance of good governance and urban planning	Evaluate 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.	Introduction to Urban Sociology	Basic Concepts and terminologies of Urban Sociology, Origin of urban societies, Rural-Urban Continuum	4
2.	Theories in Urban Sociology	The Classical Foundations of Simmel, Max Weber, Tonnies, Louis Wirth, Durkhiem and Friedrich Engels	5
3.	The Ecological View	The Chicago School, Concentric zone theory (Burgess), Sector theory (Hoyt), Multiple Nuclei theory (Harris and Ullman)	3
4.	Contemporary Urban Sociology	Political Economy of Cities, Henry Lefebvre, Class Conflict Theories, Accumulation Theory, Neoliberalism, Neo-Weberian, Neo- Marxism, Colonialism	4
5.	Mapping and Organisation	Social Area Analysis, Urban Social Divisions, Concentration and Centralization, Segregation, Cooperatives, Role of Cooperatives in Urban planning and development	4
6.	Urbanisation in India	Development of Urban Sociology in India, Evolution of and from different structures, Spatial Structures and classification of cities	4

7.	Urban Planning	Historical timeline of urban planning, Principles of Urban Planning, Need for planning, Governance, Agencies Involved, Urban local bodies	5
8.	Urban Issues in India	Level, trends, and pattern, Issues (poverty, slum, and environment) and Implications, Lessons from a pandemic	4
9.	Technology and Urbanisation	Digitisation and expansion of cities, Impact of technology on Urbanisation, role of technology in governance	4
10.	Globalisation and Urban Development	Concept of globalisation and its impact on urbanisation, new perspectives on urbanisation, emergence of Mega cities	4
11.	Sustainable Urban Development	Challenges in current model of urbanisation, Need for sustainable urban development, Tenets of sustainable development, Introduction to SDGs and their relevance to urbanisation, sustainable structures	4
Total number of Lectures			45
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20/ (Project)	
End Semester Examination		35	
TA		25 (Assignment + Quiz)	
Total		100	
<b>Project Based Learning:</b> The students would be divided into a group of 4-5. They would be asked to map and discuss the different parts of their cities. The lectures and readings on the process of urbanization and models of urbanization will form the basis for this exercise. Students would be required to critically analyse the urban spaces using sociological perspectives and theories. The students would be needed to make a presentation and also submit a report.			

<b>Recommended Reading material:</b>	
1.	Gottdiener, M., Budd, L., &Lehtovuori, P. <i>Key concepts in urban studies</i> . Sage. (2015)
2.	Lin Jan and Mele Christopher, ed. <i>The Urban Sociology Reader</i> . London: Routledge. (2005)
3.	Rao, M. S. A., ed. <i>Urban Sociology in India: Reader and Source Book</i> . New Delhi: Orient Longman. (1974)
4.	Savage, M., and Warde, A. <i>Urban sociology, capitalism and modernity</i> . Macmillan International Higher Education. (1993)
5.	Sivaramakrishnan, K.C., Kundu, Amitabh & Singh, B.N. <i>Handbook of Urbanization in India</i> . Oxford University Press (2007)
6.	Wirth, Louis. <i>Urbanism as a Way of Life</i> . American Journal of Sociology. (1938)
7.	Sharma, A.K. and Misra, B.D. <i>Urbanization in India: Issues &amp;Challenges</i> .New Delhi: Ane Books Pvt. Ltd.(2018)