

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|---------------------|-------------------------|----------------------|--|
| Subject Code | 15B1NCI738 | Semester :odd | Semester Seventh Session 2020- 2021 Month from July to December |
| Subject Name | Social Network Analysis | | |
| Credits | 3 | Contact Hours | 3+1 |

| | | |
|------------------------|------------------------------------|-------------------------------------|
| Faculty (Names) | Coordinator(s) | 1. Somya Jain 2. Pulkit Mehndiratta |
| | Teacher(s) (Alphabetically) | |

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

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|---------------------------------|--|--|--------------------------------|
| 1. | Introduction | Concepts: how services such as Facebook, LinkedIn, Twitter, etc. are using SNA to understand their users and improve their functionality. | 2 |
| 2. | Network Concept | Introduction: Graphs, Paths and components, Adjacency Matrices, Ways and Modes, Matrix Product, node degree, types of nodes and types of ties, actor attributes | 4 |
| 3. | Random network models | Erdos-Renyi , Barabasi-Albert , Watts-Strogatz small-world model, shortest path, six degree of separation | 5 |
| 4. | Social Network Visualization | Tools: Gephi, NetLogo, Pajek, EgoNet | 2 |
| 5. | Characterizing whole network | Cohesion, reciprocity, Transitivity and clustering Coefficient, Triad census | 2 |
| 6. | Network centrality | Undirected Non-valued networks: Degree, Eigenvector, 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 |
| Total number of Lectures | | | 41 |

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

Course Description

| | | | |
|--------------------|-------------------------------|--|---|
| Course Code | 15B19CI791 | Semester ODD (specify Odd/Even) | Semester VII Session 2020 -2021 Month from July to Dec 2020 |
| Course Name | Project Part – 1 (CSE) | | |
| Credits | 12 | Contact Hours | ... |

| | | |
|------------------------|--|----------------------------------|
| Faculty (Names) | Coordinator(s) | Dr. Raju Pal Prashant Kaushik |
| | Teacher(s) (Alphabetically) | Entire Department |

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

| Module No. | Title of the Module | List of Experiments | CO |
|-------------------|----------------------------|----------------------------|-----------|
| 1. | ... | ... | ... |
| 2. | ... | ... | ... |
| 3. | ... | ... | ... |
| ... | ... | ... | ... |
| <i>n.</i> | ... | ... | ... |

| Evaluation Criteria | |
|----------------------------|----------------------|
| Components | Maximum Marks |
| Mid Semester Viva | 20 |
| Final Viva | 30 |
| Project Report | 20 |
| Day to Day Work | 30 |
| Total | 100 |

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

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|---------------------|------------------|---|---|
| Subject Code | 15B29CI792 | Semester Odd (specify Odd/Even) | Semester VII Session 2020-21 Month from: July to Dec 2020 |
| Subject Name | Term Paper (CSE) | | |
| Credits | 4 | Contact Hours | --- |

| | | |
|------------------------|---------------------------------------|--------------------|
| Faculty (Names) | Coordinator(s) | Dr. Himani Bansal |
| | Teacher(s) (Alphabetically) | All faculty of CSE |

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

| Module No. | Title of the Module | Topics | Hours |
|-------------------|----------------------------|---------------|--------------|
| 1. | ... | ... | ... |
| 2. | ... | ... | ... |
| | ... | ... | ... |
| n. | ... | ... | ... |

| Evaluation Criteria | | Maximum Marks |
|---|--|----------------------|
| Components | | |
| Day to day work done prior to Midterm | | 20 |
| Mid Term seminar and report | | 20 |
| Day to day work done after Midterm & upto End Term seminar 20 | | |
| End term report | | 20 |
| End term seminar | | 20 |
| Total | | 100 |

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

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|--------------------|---------------------------|----------------------|---|
| Course Code | 16B1NCI637 | Semester ODD | Semester VIIthSession 2020 -2021 Month from Jul - Dec |
| Course Name | Meta-heuristic Algorithms | | |
| Credits | 4 | Contact Hours | 3--1 --0 |

| | | |
|------------------------|--|--------------|
| Faculty (Names) | Coordinator(s) | Dr. Raju Pal |
| | Teacher(s) (Alphabetically) | ... |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|---|-------------------------|
| C330-11.1 | Explain the concepts of optimization including single-objective, multi-objective, exploration, exploitation, unimodal, multimodal, evolutionary, and swarm-based methods. | II. Understanding |
| C330-11.2 | Apply the knowledge of meta-heuristic fundamentals to solve various complex combinatorial optimization problems | III. Applying |
| C330-11.3 | List and analyze various real-world problems as an optimization problem and examine various hybrid meta-heuristic algorithms to solve it. | IV. Analyzing |
| C330-11.4 | Solve the designed algorithms in a python programming language. | III. Applying |
| C330-11.5 | Examine empirical studies of the applied methods and draw sound conclusions on qualitative and quantitative aspects of these methods. | IV. Analyzing |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|--|--|---------------------------------------|
| 1. | Engineering Optimization | Basics of Optimization, Type of Optimization, Optimization Algorithms, Metaheuristics, Algorithm Complexity, No Free Lunch Theorems | 4 |
| 2. | A brief review of Classical Optimization Methods | Unconstrained and constrained Optimization, Gradient-Based Optimization, Linear Programming, Simplex method, Nonlinear optimization, Lagrange Multipliers, Karush-Kuhn-Tucker Conditions | 5 |
| 3. | Standard Benchmark Problems | Overview of standard benchmark functions with their parameters, multi-modal and unimodal functions, IEEE congress on Evolutionary Computation (CEC) benchmark problems | 3 |
| 4. | Evolutionary Algorithms (EA) | Basic concepts, evolutionary algorithms in discrete Evolutionary and continuous domains, Genetic Algorithm (GA): selection, crossover and mutation schemes, Binary GA, Real-coded GA, Constraint-handling in GA. | 6 |

| | | | |
|---------------------------------|---------------------------------|---|-----------|
| 5. | Other Evolutionary Algorithms | Evolutionary Programming (EP), Genetic Programming (GP), Differential Evolution (DE), Biogeography-based Optimization (BBO): Main algorithm, basic components, issues and variations. | 7 |
| 6. | Multi-objective EAs | Multi-objective genetic algorithm (MOGA): Non-dominated sorting, crowding distance, elitist model, NSGA-II. | 8 |
| 7. | Swarm based approach | Swarm intelligence, Ant colony optimization (ACO): Main algorithm, basic components, issues and variations, Artificial Bee Colony (ABC): Main algorithm, basic components, issues and variations, Particle swarm optimization (PSO): Main algorithm, basic components, issues and variations. | 6 |
| 8. | Applications and implementation | Various case studies and literature available of selected methods covered in the module. Implementation of those methods to solve real world problems in python. | 6 |
| Total number of Lectures | | | 45 |
| Evaluation Criteria | | | |
| Components | | Maximum Marks | |
| T1 | | 20 | |
| T2 | | 20 | |
| EndSemesterExamination | | 35 | |
| TA | | 25 | |
| Total | | 100 | |

| | |
|--|--|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1 | Yang, Xin-She. Engineering optimization: an introduction with metaheuristic applications. John Wiley & Sons, 2010. |
| 2 | Du, Ke-Lin, Swamy, M. N. S, “Search and Optimization by Metaheuristics: Techniques and Algorithms Inspired by Nature”, Springer, 2016. |
| 3 | Ponce-Cruz, Pedro, Arturo Molina Gutiérrez, Ricardo A. Ramírez-Mendoza, Efraín Méndez Flores, Alexandro Antonio Ortiz Espinoza, and David Christopher Balderas Silva. A Practical Approach to Metaheuristics using LabVIEW and MATLAB®. CRC Press, 2020. |
| 4 | Deb, Kalyanmoy. Multi-objective optimization using evolutionary algorithms. Vol. 16. John Wiley & Sons, 2017. |
| 5 | Yang, Xin-She. Nature-inspired optimization algorithms. Elsevier, 2014. |

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|--------------------|------------------------------------|----------------------|--|
| Course Code | 16B1NCI733 | Semester Odd | Semester VII Session 2020 -2021 Month from August'20 to December'20 |
| Course Name | Data Compression Algorithms | | |
| Credits | 4 | Contact Hours | 3-1-0 |

| | | |
|------------------------|--|---|
| Faculty (Names) | Coordinator(s) | Dr. SHRUTI JAISWAL (JIIT-128) Dr. TRIBHUWAN KUMAR TEWARI (JIIT-62) |
| | Teacher(s) (Alphabetically) | Dr. SHRUTI JAISWAL Dr. TRIBHUWAN KUMAR TEWARI |

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

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

| | | | |
|---------------------------------|--|--|-----------|
| | | DPCM, DM. MPEG audio compression , Psychoacoustics, frequency masking, temporal masking, MPEG layers 1-2-3(MP3), MPEG compression algorithm. MPEG-2 advance coding system (AAC), MPEG-4 audio compression. | |
| 6. | Compression problems & Algorithmic solutions | Compression performance, Limits on lossless compression, Compression in machine learning approaches with some case study, DeepZip: Lossless Compression using Recurrent Networks | 3 |
| Total number of Lectures | | | 42 |

Evaluation Criteria

| Components | Maximum Marks |
|--------------------------|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Attendance(10), Assignments (5), Quiz (10)) |
| Total | 100 |

Recommended Reading material:

Text Books

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

Reference Books and Journals

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

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|------------------|-----------------------|--|
| Course Code | 16B1NCI831 | Semester : Odd | Semester 7th Session 2020-2021 Month from July 2020 to Dec 2020 |
| Course Name | Machine Learning | | |
| Credits | 4 | Contact Hours | 3-1-0 |

| | | |
|------------------------|--|---------------|
| Faculty (Names) | Coordinator(s) | Dr. Arti Jain |
| | Teacher(s) (Alphabetically) | Dr. Arti Jain |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|-----------------|---|----------------------|
| C430-11.1 | To learn basic concepts of probability, statistics, linear algebra, convex optimization. | Remember (Level 1) |
| C430-11.2 | To understand concepts of learning system, supervised learning, unsupervised learning. | Understand (Level 2) |
| C430-11.3 | Apply techniques to handle issues related to learning model such as overfitting, feature scaling, and dimensionality reduction. | Apply (Level 3) |
| C430-11.4 | Compare the different learning models using the evaluation parameters. | Analyze (Level 4) |
| C430-11.5 | Determine the applicability of a learning model for a given problem. | Evaluate (Level 5) |
| C430-11.6 | Design a learning model for a specific real-world problem. | Create (Level 6) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---------------------------------|--------------------------|---|--------------------------------|
| 1. | Introduction | Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system. Linear Algebra review. | 04 |
| 2. | Supervised Learning | Linear regression, Logistic Regression, Support Vector Machine, Maximum Entropy, Hidden Markov Model, Overfitting, noisy data, and pruning, Active Learning-Bagging and Boosting. | 10 |
| 3. | Unsupervised Learning | Learning from unclassified data, Hierarchical Agglomerative Clustering. Partitional clustering. Expectation maximization (EM). Semi-supervised learning with EM using labelled and unlabelled data, reinforcement learning. | 11 |
| 4. | Dimensionality Reduction | Feature Extraction, PCA, LDA, Feature Scaling. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing. | 7 |
| 5. | Deep Learning | Perceptions: representational limitation and gradient descent training. Multilayer networks and back propagation, Convolutional Neural Networks, Recurrent Neural Networks. | 10 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | Maximum Marks | | |

| | |
|--------------------------|------------|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| Total | 100 |

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

Text Book(s):

| | |
|----|---|
| 1. | Ethem Alpaydin , Introduction to Machine Learning, Second Edition. |
|----|---|

| | |
|----|---|
| 2. | Stephen Marsland , Machine Learning: An Algorithmic Perspective. |
|----|---|

Reference Book(s):

| | |
|----|--|
| 3. | Christopher M. Bishop , Pattern Recognition and Machine Learning. |
|----|--|

Detailed Syllabus Interconnection Networks in Computer Architecture (16B1NCI836)

Lecture-wise Breakup

| | | | |
|--------------------|---|-----------------|---|
| Course Code | 16B1NCI836 | Semester Odd | Semester_VII__ Session2020-21 Month: from JUL to DEC |
| Course Name | Interconnection Networks in Computer Architecture | | |
| Credits | 4 | Contact Hours | 3-1-0 |
| Faculty (Names) | Coordinator(s) | Bansidhar Joshi | |
| | Teacher(s) (Alphabetically) | | |

COURSE OUTCOMES

| Sn. No. | DESCRIPTION | COGNITIVE LEVEL(BLOOMS TAXONOMY) |
|-----------|--|----------------------------------|
| C430-10.1 | Outline the architecture, design methodology, and characteristics of interconnection networks | Understand(Level 2) |
| C430-10.2 | Identify various topologies and routing schemes for On-Chip Networks | Applying (Level 3) |
| C430-10.3 | Analyze various flow control mechanisms in On-Chip Networks for deadlock/livelocks avoidance | Analyzing(Level 4) |
| C430-10.4 | Explain the functioning of Arbitration and Allocation schemes in router's micro-architecture | Evaluate(Level 5) |
| C430-10.5 | Propose and present solutions for effective communication in various interconnection network architectures | Create(Level 6) |

| Module No. | Title of the Module | Topics in the module | No. of Lectures for the module |
|------------|---|---|--------------------------------|
| 1. | Introduction to Interconnection Networks | Introduction, Types of Networks, Evaluation Metrics | 6 |
| 2. | Topology | Metrics for comparing topologies, Direct Topologies, Indirect Topologies, Hierarchical Topologies | 5 |
| 3. | Routing | Deterministic Routing, Oblivious Routing, Adaptive Routing | 5 |
| 3. | Flow-Control | Message-based Flow Control, Packet-based Flow Control, Flit-based Flow Control, Virtual Channels | 6 |
| 4. | Deadlocks | Channel Dependency Graph Turn Model Up*/Down* Routing Escape Virtual Channels Deadlock Recovery | 5 |
| 5. | Microarchitecture | Router Organization, Pipeline, Optimizations, Buffer Management, Crossbar Design, Allocators and Arbiters | 8 |
| 7. | End Term Presentations | Topology, routing, flow-control and microarchitecture | 5 |
| | | Total number of Lectures | 40 |

| Evaluation Criteria | |
|---|--|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| Total | 100 |
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | W. Dally and B. Towles, "Principles and Practices of Interconnection Networks," Morgan Kauffman Publishers, 2004 |
| 2. | N. E. Jerger, T. Krishna, and L.-S Peh, "On-Chip Networks, 2nd Edition" Morgan Claypool Publishers, 2017. |
| 3. | Papers from recent conferences: ISCA, MICRO, HPCA, ASPLOS, SIGCOMM, NSDI, NOCS, DATE, DAC, ISSCC |

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|--------------------|-------------------|---|--|
| Course Code | 16B1NHS831 | Semester: Odd (specify Odd/Even) | Semester: VII Session 2020 -2021 Month: July2020 -Dec2020 |
| Course Name | Gender Studies | | |
| Credits | 3 | Contact Hours | 3-0-0 |

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

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|--|-------------------------|
| C401-19.1 | Demonstrate knowledge of the construct of gender and the way it intersects with other social and cultural identities of race, class, ethnicity and sexuality | Understand (C2) |
| C401 - 19.2 | Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity and masculinity | Apply (C3) |
| C401- 19.3 | Analyze the ways in which societal institutions and power structures such as the family, workplace impact the material and social reality of women's lives | Analyze (C4) |
| C401-19.4 | Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporary settings | Evaluate (C5) |
| C401- 19.5 | Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies | Evaluate (C5) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|---|--|---------------------------------------|
| 1. | Introducing Gender Issues | <ul style="list-style-type: none"> • Sex and Gender • Types of Gender • Gender Roles • Gender Division of Labor • Gender Stereotyping and Gender Discrimination | 9 |
| 2. | Gender Perspectives of Body & Language | <ul style="list-style-type: none"> • Biological, Phenomenological and Socio-Cultural Perspectives of body • Body as a Site and Articulation of Power Relations • Cultural Meaning of Female Body and Women's Lived Experiences • The Other and Objectification | 6 |
| 3. | Social Construction of Femininity & Feminism | <ul style="list-style-type: none"> • Bio-Social Perspective of Gender • Gender as Attributional Fact • Feminine & Feminist • Major Theorists of Feminism Challenging Cultural Notions of Femininity • Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism & Cyberfeminism • Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ; Cultural Feminism & | 9 |

| | | | |
|---------------------------------|--|--|-----------|
| | | Celebrating Womanhood <ul style="list-style-type: none"> • Analysis of role women have played across cultures | |
| 4. | Social Construction of Masculinity | <ul style="list-style-type: none"> • Definition and Understanding of Masculinities • Sociology of Masculinity & its Types • Social Organization of Masculinity and Privileged Position of Masculinity • Politics of Masculinity and Power • Major Theorists of Masculinity • Masculine Identities in Literature, Cinema & Media. | 9 |
| 5. | Gender Sensitization Empowerment & Gender Inclusivity | <ul style="list-style-type: none"> • Women & Women Rights In India • From Women's Studies to Gender Studies: A Paradigm Shift • Gender Sensitization & Gender Inclusivity • Gender Studies & Media: Creating New Paradigms in Gender & Culture | 9 |
| Total number of Lectures | | | 42 |

| Evaluation Criteria | |
|----------------------------|--------------------------|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Project/ Assignment) |
| Total | 100 |

| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
|---|--|
| 1 | Davis K., et al, " <i>Handbook of Gender and Women's Studies</i> . London: Sage. (2006) |
| 2 | Helgeson, Vicki S., " <i>The Psychology of Gender</i> ", Pearson(2012) |
| 3 | Friedan B., " <i>The Feminine Mystique</i> ", Penguin. (1971/1992) |
| 4 | Debeauvoir S. , " <i>The Second Sex</i> ", Vintage (1953/1997) |
| 5 | Wharton Amy S., " <i>The Sociology of Gender: An Introduction to Theory & Research</i> ", Wiley-Blackwell (2005) |
| 6 | Pachauri G., " <i>Gender, School & Society</i> ", R.Lall Publishers(2013) |
| 7 | Connell R.W, " <i>Masculinities</i> ", Cambridge: Polity. (1985) |
| 8 | MacInnes J., " <i>The End of Masculinity</i> ". Buckingham: Open University Press. (1998) |
| 9 | Kaul A.& Singh M., " <i>New Paradigms for Gender Inclusivity</i> ", PHI Pvt Ltd (2012) |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|------------------------|--|---|
| Course Code | 17B1NBT732 | Semester Odd (specify Odd/Even) | Semester VII Session 2019 -2020 Month from July-December |
| Course Name | Healthcare Marketplace | | |
| Credits | 3 | Contact Hours | 3 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|--|---|---------------------------------------|
| 1. | Introduction to Healthcare markets | About the various Regulatory bodies for approval of new medical innovations | 02 |
| 2. | Clinical Pharmacokinetics and Clinical trials for new Drugs | Biologic sampling techniques, analytical methods for the measurement of drugs and metabolites, and procedures that facilitate data collection and manipulation. Clinical Trials: PhI, II, III and IV | 05 |
| 3. | Regulatory approval pathways | Preclinical studies US and EU filings IND submissions, NDA and BLA Submissions, Non-patent exclusivities, data and market exclusivities cost analysis | 06 |
| 4. | Patents of drugs and devices, Entry for generics in health care markets | Role of patents on new drugs and devices, Ever-greening of patents, Product and Process patents. Hatch Waxman act and Introduction of generics and resulting cost reduction, Orange book (FDA) and related case studies. | 08 |
| 5. | Economics of healthcare | Stakeholders in healthcare- doctors, hospitals and insurers and 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 marketplace | Health to market innovations | 4 |

| | | | |
|---------------------------------|-------------------------------|--|-----------|
| | | | |
| 9 | Healthcare informatics | e-health, collection of health data, data processing, evaluation, health information systems, case studies | 2 |
| Total number of Lectures | | | 42 |

| | |
|----------------------------|--------------------------------------|
| Evaluation Criteria | |
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Assignments 1, 2, 3, Attendance) |
| Total | 100 |

| | |
|---|--------------------------------------|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Research papers and online resources |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|---|--|---|
| Course Code | 17B1NBT733 | Semester Odd (specify Odd/Even) | Semester VII Session 2019 -2020 Month from July-December |
| Course Name | Stress: Biology, Behaviour and Management | | |
| Credits | 3 (3-0-0) | Contact Hours | 3 |

| | | |
|------------------------|--|-------------|
| Faculty (Names) | Coordinator(s) | Vibha Gupta |
| | Teacher(s) (Alphabetically) | Vibha Gupta |

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|------------|---|---|---|
| 1. | Introduction | The concept of Stress - Major stressors vs. routine hassles ; Major types of Stressors - Occupational Stressors; Organization Stress; Environmental Stressors; Happy Interactive Class (HIC) | 3 |
| 2. | Scientific Foundations of Stress | HIC 1, The Nature of Stress; Human Physiology; Stress and Relaxation Responses; Stress and Disease | 5 |
| 3. | Body Systems activated by stressors | HIC2, Nervous System, Endocrine System, immune system, Cardiovascular system, Gastrointestinal System, Muscles | 9 |
| 4. | Cognitive Psychology | HIC3, Theoretical models: psychodynamic, behavioral, and cognitive; Thoughts, Beliefs and Emotions: Behavioral Patterns; Self-concept and Self-esteem; Stress emotions - Anger and Fear; Personality Traits – Stress prone and Stress resistant | 11 |
| 5. | Social Psychology | HIC4, Family and Culture; Demands and Responsibilities; Relationships; Verbal and Non-verbal Communication; Human Spirituality | 3 |
| 6. | Stress and the Human Environmental Interactions | HIC4, Time; Body Rhythms; Weather and Climate; Nutrition; Exercise; Drugs and Addictions; Violence and Post Traumatic Stress | 3 |
| 7. | Happy Interactive Class (HIC) related to Stress management techniques and | HIC1 - DIY Strategies- Exercise and Health; HIC2 - Journal Writing/Music and Art Therapy; HIC3- Humor and Comic Relief; HIC4- Meditation/Mindfulness/Belly Breathing/Visual Imagery/Progressive Muscle Relaxation Psychological interventions; Developing Cognitive | HICs to be delivered in the modules 1-6 |

| | | | |
|---------------------------------|------------------------|---|-----------|
| | therapeutic strategies | Coping Skills; Creative Problem Solving (case studies); | 4 |
| 8. | The adaptive brain | Neuroplasticity – positive adaptation to stress | 2 |
| Total number of Lectures | | | 40 |

| | |
|----------------------------|--|
| Evaluation Criteria | |
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Project, Quiz and class discussions) |
| Total | 100 |

| | |
|---|--|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | George Fink “Stress: Concepts, Cognition, Emotion, and Behavior: Handbook in Stress Series; Volume 1; Academic Press; 2016 |
| 2. | Jeanne Ricks “The Biology of Beating Stress”Kindle Edition; 2014 |
| 3. | Jerrold S. Greenberg “Comprehensive Stress Management” Tata McGraw-Hill Edition; Tenth Ed., 2009 |
| 4. | Brian Luke Seaward “Managing Stress: Principles and Strategies for Health and Well-Being” Sixth Ed., Jones and Bartlett Publishers, 2009 |
| 5. | Saundra E. Ciccarelli, and Glenn E. Meyer “Psychology” South Asian Edition; Published by Pearson Education (2008); ISBN 10:8131713873 / ISBN 13: 9788131713877 |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|--|--|---|
| Course Code | 17B1NCI731 | Semester ODD (specify Odd/Even) | Semester VII Session 2020-2021 Month from Jul 2020 |
| Course Name | Machine Learning & Natural Language Processing | | |
| Credits | 4 | Contact Hours | 3-1-0 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|------------|-------------------------|---|--------------------------------|
| 1. | Introduction | Introduction to Machine Learning & NLP, Challenges | 3 |
| 2. | Mathematical Foundation | Probability Theory, Vector Spaces, Matrix algebra, Probability, Data representation, Tokenization, Lemmatization | 5 |
| 3. | Parts of Speech Tagging | Various Models: Hidden Markov Model, SVM, CRF, RNN, LSTM | 11 |
| 4. | Parsing | Linguistic Essentials, Markov Models, Applications of tagging, Probabilistic parsing - CFG, CSG, PCFG | 8 |
| 5. | Document classification | Supervised: Bayesian, Naive Bayes, N-gram model, sentiment analysis, text classification, Unsupervised: K-means, Expectation-Maximization (EM) algorithm, MaxEnt classifier | 8 |
| 6. | Topic Modelling | Topic Modelling: Latent Dirichlet Allocation (LDA) and its Variants | 2 |

| | | | |
|----|--------------|--|---|
| 7. | Applications | Document summarization, Co-referencing, noun phrase chunking, named entity recognition, co-reference resolution, parsing, information extraction, Machine Translation, Spell Correction, News Article Title Generation, Code Categorization, Question Answering (Eliza). | 5 |
|----|--------------|--|---|

| | | |
|---------------------------------|--|-----------|
| Total number of Lectures | | 42 |
|---------------------------------|--|-----------|

| Evaluation Criteria | |
|-----------------------------------|----------------------|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| i) Attendance = 07 | |
| ii) Class Test, Quizzes, etc = 07 | |
| iii) Internal assessment = 05 | |
| iv) Assignments in PBL mode = 06 | |
| Total | 100 |

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

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

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

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

| | |
|---|---|
| 1 | Olive, Joseph, Christianson, Caitlin, McCary, John (Eds.) : Handbook of Natural Language Processing & Machine Translation, Springer |
|---|---|

| | |
|---|---|
| 2 | Philipp Koehn : Statistical Machine Translation, Cambridge University Press |
|---|---|

| | |
|---|--|
| 3 | Edited by Sergei Nirenburg, H. L. Somers, Yorick Wilks, Readings in Machine Translation, MIT Press |
|---|--|

| | |
|---|--|
| 4 | James Allen : Natural Language Understanding, Benjamin Cummins Publisher |
|---|--|

| | |
|---|--|
| 5 | HinrichSchtze, Christopher D. Manning : Foundations of Statistical NLP |
|---|--|

| | |
|---|---|
| 6 | Steven Bird, Ewan Klein, and Edward Loper : Natural Language Processing with Python |
|---|---|

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|---------------------------|--|---|
| Course Code | 17B1NCI732 | Semester Odd (specify Odd/Even) | Semester VII Session 2020 -2021 Month from July - Dec |
| Course Name | Computer and Web Security | | |
| Credits | 4 | Contact Hours | 3-1-0 (L-T-P) |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|--|---|---------------------------------------|
| 1. | Vulnerability-Threat-Control Paradigm | Threats: Confidentiality, Integrity, Availability, Types of Threats, Types of Attackers, Software Security: Buffer Overflow, Coding threats | 3 |
| 2. | Software Security Issues | Unintentional insecure Coding Practices, Buffer Overflow, Format String vulnerabilities, Stack Smashing | 6 |
| 3. | Malware | Virus, Worms – Definition , Modelling and Solutions | 5 |
| 4. | Malware Detection systems | Worm Detection, Worm Signature Extraction, Virus Detection, Intrusion Detection Systems – Anomaly Vs Signature Based and Host vs Network Based | 4 |
| 5. | Web Access Threats | Web Browser Attacks: Browser Attack Types, Web Attacks Targeting Users, Obtaining User or Website Data, Code within Data, Foiling Data Attacks, Email Attacks: Phishing | 6 |
| 6. | Access Control -1 | Access Control and Authorization in OS | 4 |
| 7. | Access Control -2 | Authentication Protocols | 4 |
| 8. | Non-Cryptographic network protocol vulnerabilities | Threats to Network Communications, Denial of Service: Flooding Attacks, Network Flooding Caused by Malicious Code, Network Flooding by Resource Exhaustion, Denial of Service by Addressing Failures, Traffic Redirection, DNS Attacks, Exploiting Known Vulnerabilities Distributed Denial-of-Service: Scripted Denial-of-Service Attacks, Bots, Botnets | 7 |

| | | | |
|---------------------------------|--|---|-----------|
| 9. | Cryptographic Solution | Types of Cryptography , Key Management, Digital Signature | 3 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | Maximum Marks | |
| T1 | | 20 | |
| T2 | | 20 | |
| End Semester Examination | | 35 | |
| TA | | 25 (Tut(5) + Attendance(10) + Quiz(5) + Assignment(5)) | |
| Total | | 100 | |
| Text Books: | | | |
| T1. | Stallings and Brown, <i>Computer Security: Principles and Practice</i> , 3/e (2014, Prentice Hall). | | |
| T2. | Paul van Oorschot, <i>Computer Security and the Internet: Tools and Jewels</i> (2020, Springer). | | |
| T3. | Wenliang Du, <i>Computer Security: A Hands-on Approach</i> (2017, self-published). | | |
| Reference Books: | | | |
| R1. | Gollmann, <i>Computer Security</i> , 3/e (2011, Wiley). | | |
| R2. | Stamp, <i>Information Security: Principles and Practice</i> , 2/e (2011, Wiley). | | |
| R3. | Pfleeger and Pfleeger, <i>Security in Computing</i> , 4/e (2007, Prentice Hall). | | |
| R4. | Menezes, van Oorschot and Vanstone, <i>Handbook of Applied Cryptography</i> (CRC Press, 2001). | | |
| R5. | Kaufman, Perlman and Speciner, <i>Network Security: Private Communications in a Public World</i> , second edition (Prentice Hall, 2003). | | |
| R6. | Pachghare V. K. , <i>Cryptography And Information Security</i> (2015, PHI). | | |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|---------------------|-----------------|-----------------------|--|
| Subject Code | 17B1NCI747 | Semester (ODD) | Semester VII Session 2020 - 21 Month from July to Dec |
| Subject Name | Cloud Computing | | |
| Credits | 4 | Contact Hours | 3 Lectures+ 1 Tutorial |

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

| COURSE OUTCOMES | | <u>Cognitive Level</u> |
|------------------------|---|-------------------------------|
| C430-8.1 | Understand various Deployment Models , Cloud Service Models, Essential Characteristics, Foundational Elements and Enablers, Cloud Architecture. | Understanding (Level 2) |
| C430-8.2 | Analyze various Virtualization Techniques, Virtual Machine Provisioning, Migration techniques and their performances in cloud environments. | Analyze Level (Level 4) |
| C430-8.3 | Analyze the performances of resource management and scheduling techniques in cloud environments. | Analyze Level (Level 4) |
| C430-8.4 | Analyze and evaluate the performance of various energy aware computational techniques used in Cloud environments. | Evaluate (Level 5) |
| C430-8.5 | Develop sustainable systems using cloud based methods and techniques. | Apply Level (Level 3) |

Detailed Syllabus

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|-------------------|---|---|---------------------------------------|
| 1. | Overview of Distributed Computing | Trends of computing, Distributed Computing, System models for Distributed, Client Server Models, Peer to Peer Models, Next big thing: cloud computing, Cloud Computing, Pay-as-per-use Model, Enabling Technologies | 2 |
| 2. | Introduction to Cloud Computing , Issues and Challenges | What's cloud computing, History of cloud computing, Correlation between distributed and Cloud Computing | 1 |
| | | Deployment Models , Private, Public, Community, Hybrid, Service models, SaaS, PaaS, IaaS. Essential Characteristics, Foundational Elements and enablers of Cloud Model | 2 |

| | | | |
|---------------------------------|--|--|-----------|
| | | Current issues and challenges of cloud computing, Management of Data Centers, Energy aware Issue etc. | 1 |
| 3. | Cloud Architecture | Traditional computing architecture, Layers of traditional architecture, their pros and cons. | 1 |
| | | Cloud Computing Architecture, Role of Virtualization, Various Models | 2 |
| | | Role of network in cloud computing, Providing High speed communication bandwidth | 1 |
| 4. | Virtualization Technifues | Role of Virtualization in Cloud Computing, Virtualization of resources and related issues. | 1 |
| | | Virtualization Technologies, Virtual Machine Monitors, Virtual Machines | 1 |
| | | Virtualization Techniques, ISA Level virtualization, Hardware Abstraction level, OS level, Library Level, Application Level virtualization techniques. | 2 |
| | | VM Provisioning , Cloud Resource Virtualization, Hardware support for Virtualization. Case Study. Open Source VMM | 2 |
| | | Introduction to Intel Virtualization Technology (IVT), Intel IA-32 and Itanium Architectures, Challenges in the design of these architectures | 2 |
| | | Addressing the challenges by VTx and VTi architectures. Root Mode and Non-root mode operations of VTx and VTi | 2 |
| 5. | Energy Aware Computing in Cloud, Resource Management, Scheduling and Load Balancing techniques | Resource Management, Resource scheduling and load balancing techniques and their performance analysis. | 4 |
| | | Energy Aware concepts and techniques, Energy Aware computations with DVFS. | 4 |
| 6. | Cloud Simulation platforms and frameworks | Open Source Frameworks CloudSim, GridSim, iFogSim etc. VMs, Data Centers in Cloudsim and iFogSim environments | 4 |
| 7. | Cloud Security | Current state of data in cloud and data security in cloud, Network level security, Data level security, | 3 |
| | | Access management and control, Authentication in cloud computing | 2 |
| 8. | Cloud computing and IoT | Introduction to Cloud and IoT platforms. | 2 |
| | | Open Source Cloud and IoT integration | 2 |
| | | Applications of Cloud and IoT for Sustainable developments | 2 |
| Total number of lectures | | | 42 |

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

| Text Books: | |
|--|---|
| 1. | K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, “Distributed and Cloud Computing- From Parallel Processing to the Internet of Things”, Morgan Kauffman Publishers, Elsevier. |
| 2. | R. K. Buyya, J Broberg, Adnrzej Goscinski, “Cloud Computing: Principles and Paradighms”, Wiley Publisher. |
| 3 | Dan C. Marinescu, “Cloud Computing: Theory and Practice”, Morgan Kauffman Publishers, Elsevier. |
| 4 | Tanenbaum, A.S, Marten, V. Steen, Distributed Systems : Principles and Paradigms, 2 nd Edition, Prentice Hall . |
| 5. | Barrie Sosinsky, “Cloud Computing Bible” Wiley India Publishers, 2013. |
| 6. | Arshadeep Bagha, Vijay Madiseti, “Cloud Computing: A HandsOn Approach” University Press, 2014. |
| Reference Books and other Materials | |
| 1. | George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O’REILLY publication. |
| 2. | Rich Uhlig, et. al., “Intel Virtualization Technology” IEEE Journal, 2005. |
| 3. | Shailendra Singh, “Cloud Computing” Oxford University Press, 2018. |
| 4. | “Introduction to Cloud Computing Architecture” Sun’s White Paper, 1 st Edition, June, 2009. |
| 5. | Tanenbaum, A. S Distributed Operating Systems, 1 st Ed., Prentice-Hall, Englewood Cliffs, NJ, 1995. |
| 6. | Sanderson, Dan, Programming Google’s Application Engine, O’Reilly, Google Press. |
| 7. | IEEE, ACM Transactions, Journals and Conference papers on “Distributed and Cloud Computing.” |
| 8. | “Virtualization Overview”, White paper, VM Ware. |
| 9. | “Implementing Virtualization” White paper, Intel virtualization Technology, 2008 |
| 10. | Tulloch, Mitch, Understanding Microsoft virtualization solutions: From the Desktop to Data Center, Microsoft Press. |

**** Highlighted texts are the updations (subject to BOS for approval).**

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|-----------------------------------|--|---|
| Course Code | 17B1NCI748 | Semester Odd (specify Odd/Even) | Semester VII Session 2020 -2021 Month from July 20 to Dec 20 |
| Course Name | Graph Algorithms and Applications | | |
| Credits | 4 | Contact Hours | 3-1-0 |

| | | |
|------------------------|--|------------|
| Faculty (Names) | Coordinator(s) | MuktaGoyal |
| | Teacher(s) (Alphabetically) | MuktaGoyal |

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|--|--|---------------------------------------|
| 1. | Introduction | Scope, Basic concepts and terminology, Adjacency Matrix, Incidence Matrix, Cycle Matrix, Cut-set Matrix, Path Matrix, Determining lower bounds, Adversary arguments, Problem reductions, NP-completeness, etc. | 1 |
| 2. | Applications of Connectivity and Reliability | Reliable communication network design, Cycle detection, Searches, Multiway cut, Minimum K-cut, etc. | 5 |
| 3. | Applications of Traversability | Shortest paths, Optimal tours, Euler's Cycle, Hamiltonian Cycle, TSP, etc. | 4 |
| 4. | Applications of Trees | Spanning trees, Steiner Tree, Minimum cost constructions, Coding theory, Phylogeny construction, etc. | 4 |
| 5. | Applications of Matching/Partitioning | Personnel assignment, Optimal assignment, Hungarian Algorithm, Territory demarcation, Stable Marriage, Project Allocation, etc. | 5 |
| 6. | Applications of Coverings | Vertex Cover, Set Cover, Shortest superstring, Geometric problems, etc. | 4 |
| 7. | Applications of Colourability | Storage management, Timetable schedules, etc. | 3 |

| | | | |
|---------------------------------|---------------------------|--|-----------|
| 8. | Applications of Planarity | Planarity detection, PCB design, Facilities layout and floor plan design, Software testing, Defense strategies, etc. | 4 |
| 9. | Applications of Digraphs | Circuit theory and electrical network analysis, Transport networks, Job sequencing, Disk scheduling, Participant rankings in tournaments, Choice consistency, Project planning, etc. | 5 |
| 10. | Applications of Flows | Max-flow min-cut, Feasible flows, Transportation problems, etc. | 4 |
| 11. | Graph Databases | <i>Embrace Relationships with Graph Databases, Querying Graphs: Cypher Query Language, Graph Database Application</i> | 3 |
| Total number of Lectures | | | 42 |

| Evaluation Criteria | |
|----------------------------|---|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Attendance-07, Assignments-07, Quiz-05, Paper Reading-06) |
| Total | 100 |

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

Text Books:

| | |
|----|---|
| 1. | Ray, S. S. (2012). <i>Graph theory with algorithms and its applications: in applied science and technology</i> . Springer Science & Business Media. |
| 2. | Deo, N. (2017). <i>Graph theory with applications to engineering and computer science</i> . Courier Dover Publications. |

Reference Books:

| | |
|----|---|
| 3. | Harary, F. (1969). <i>Graph Theory</i> . Addison Wesley Publishing Company. <i>Reading, MA, USA.</i> [Google Scholar]. |
| 4. | Garg, N., Vazirani, V. V., & Yannakakis, M. (1994, July). Multiway cuts in directed and node weighted graphs. In <i>International Colloquium on Automata, Languages, and Programming</i> (pp. 487-498). Springer, Berlin, Heidelberg. |
| 5. | West, D. B. (1996). <i>Introduction to graph theory</i> (Vol. 2). Upper Saddle River, NJ: Prentice hall. |
| 6. | Gibbons, A. (1985). <i>Algorithmic graph theory</i> . Cambridge university press. |

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|---------------------|------------------|----------------------|--|
| Subject Code | 17B1NCI749 | Semester ODD | Semester: VII Session 2020-2021 Month from Jul 2020 to Dec 2020 |
| Subject Name | MOBILE COMPUTING | | |
| Credits | 4 | Contact Hours | 3-1-0 (L-T-P) |

| | | |
|------------------------|------------------------------------|-----------------|
| Faculty (Names) | Coordinator(s) | 1. Nitin Shukla |
| | Teacher(s) (Alphabetically) | 1. Nitin Shukla |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|--|----------------------------|
| C431-4.1 | Assess the suitability of different techniques in multiplexing, modulation, spread spectrum, frequency reuse factor for specific wireless network requirements | Evaluate Level [Level 5] |
| C431-4.2 | Identify important issues and concerns on security and privacy of a mobile computing environment and assess technical solution for security and privacy of user data. | Apply Level [Level 3] |
| C431-4.3 | Analyze performance aspects of medium accessing, transport layer methodologies and routing techniques in wireless networks (WLAN, WPAN) and mobile networks (GSM, UMTS, UTRAN). | Analyze Level [Level 4] |
| C431-4.4 | Apply functional aspects of Android mobile operating system in developing mobile applications. | Apply Level [Level 3] |
| C431-4.5 | Build contemporary mobile applications based on different widgets, different views and view groups, SMS, mail, and location aware services through Internet for mobile environments. | Create Level [Level 6] |
| C431-4.6 | Explain the working of different protocols for mobile network layer and mobile transport layer. | Understand Level [Level 2] |

| Module No. | Title of the Module | Topics in the module | No. of Lectures for the module |
|-------------------|----------------------------|--|---------------------------------------|
| 1. | Introduction | Introduction to mobile computing: Applications, mobile and wireless devices, history of wireless communication, open research topics, simplified reference model | 3 |
| 2. | Wireless Transmission | Frequency for radio transmission, regulation, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular systems | 6 |
| 3. | Medium Access Control | Specialized MAC, Hidden and exposed terminals, near and far terminals, SDMA, FDMA, TDMA, CDMA., comparison of S/T/F/CDMA | 4 |

| | | | |
|---------------------------------|--|--|-----------|
| 4. | Telecommunication Systems | GSM: Mobile Services, System Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, Data Services, UMTS and UTRAN, Core Network, Handover | 6 |
| 5. | Wireless LAN | Infrastructure and ad-hoc network, IEEE802.11: System architecture, protocol architecture, Physical Layer, Medium access control layer, MAC management, 802.11b, 802.11a, HIPERLAN, Bluetooth | 5 |
| 6. | Mobile network Layer | Mobile IP, Dynamic host configuration protocol, mobile ad-hoc networks, routing | 4 |
| 7. | Mobile transport layer | Traditional TCP: congestion control, slow start, fast retransmit/fast recovery, implications of mobility, TCP improvements, TCP over 2.5, 3.5 wireless networks, performance enhancing proxies, Mobility. | 4 |
| 8. | Mobile Operating Systems | Android OS- Installing, Setup, Getting started, Making and testing Android projects, Basic program structure, Java-based layout, XML-based layout, Hybrid layout, Project structure summary, Android Programming: running Simple 'Hello World' Applications. | 8 |
| 9. | Research Issues in Wireless and Mobile Computing | Mobile networking, Quality of Service in Mobile Networks, Mobile access to World-Wide-Web, Mobile Data Management, Mobile Transactions, Mobile Computing Models | 2 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | Maximum Marks | |
| T1 | | 20 | |
| T2 | | 20 | |
| End Semester Examination | | 35 | |
| TA | | 25 (Attendance: 10 Marks, Quiz/Assignment/Mini-Project: 15 Marks) | |
| Total | | 100 | |

Project Based Learning: A group of 3-4 students were given mini-project to develop android mobile application considering learning of GSM/UMTS network performance, and various Mobile Networking QoS features.

| | |
|---|---|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Jochen Schiller, "Mobile Communications", second edition, Addison-Wesley, 2004. |
| 2. | Stojmenovic, and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002. |
| 3. | Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, 2004. |

| | |
|-----|--|
| 4. | Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill Professional, 2005 |
| 5. | Hansmann, Merk, Nicklous, Stober, “Principles of Mobile Computing”, Springer, second edition, 2003. |
| 6. | Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley DreamTech, 2003. |
| 7. | Raj Kamal, “Mobile Computing”, first edition, Oxford University Press, 2007. |
| 8. | Asoke K Talukder, and Roopa R. Yavagal, “Mobile Computing: Technology, Application and Service Creation”, Tata McGraw-Hill Professional, 2005 |
| 9. | Abdelsalam Helal, “Any Time, Anywhere Computing: Mobile Computing Concepts and Technology”, Kluwer Academic Publishers, 1999. |
| 10. | IEEE Transaction on Broadcasting |
| 11. | IEEE Transaction on Communication |
| 12. | IEEE Transaction on Computers |
| 13. | IEEE Transaction on VT |
| 14. | IEEE Communication Letters |

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|--------------------|----------------------------------|----------------------|--|
| Course Code | 17B1NHS731 | Semester:Odd | SemesterVII Session 2020 -2021 Month from July 2020 to Dec 2020 |
| Course Name | Customer Relationship Management | | |
| Credits | 3 | Contact Hours | 3-0-0 |

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

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

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

| | | | |
|---------------------------------|---|---|-----------|
| | | Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation. ***Dominos using different types of content to practice engagement | |
| 5. | Components of e CRM solutions (Overview) and Role of Digital Technologies | Data warehousing, Datamining and CRM, Market Basket Analysis and Retail sector, Campaign Management, Sales Force Automation, Customer Service and Support, Corporate Blogs, Online communities, Twitter, Wikis. The Experience ecosystem. CEM, Consumer engagement, segmentation and differentiation. ** Exercise on online campaign management solutions | 7 |
| 6. | Product offerings in the CRM Marketplace (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 inimplementing 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, SocialCustomer Insights, Social CRM Strategy, and Social Customer Analytics. * Excercise on Mckinsey's social media model | 5 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | MaximumMarks | |
| T1 | | 20 | |
| T2 | | 20 | |
| EndSemesterExamination | | 35 | |
| TA | | 25 | |
| Total | | 100 | |

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

| | |
|----|---|
| 1. | Customer Relationship Management, Ed. Peelan Rob Beltman, 2 nd Edition, Pearson, 2014. |
| 2. | Ou, Y. C., Verhoef, P. C., & Wiesel, T. The effects of customer equity drivers on loyalty across services industries and firms. <i>Journal of the Academy of Marketing Science</i> , 45(3), 336-356, 2017. |
| 3. | Lin, Y. C., Lee, Y. C., & Lin, S. Y. The influence of the personality traits of webcasters on online games. <i>International Journal of Electronic Customer Relationship Management</i> , 11(1), 94-103, 2017 |
| 4. | Menzel, C. M., &Reiners, T.Customer relationship management system a case study on small-medium-sized companies in north Germany. In <i>Information Systems for Small and Medium-sized Enterprises</i> pp. 169-197. Springer, Berlin, Heidelberg, 2014. |
| 5. | Customer Relationship Management-A strategic perspective, G. Shainesh, Jagdish Sheth, Reprinted Macmillan Publishers India Limited, 2009. |
| 6. | Mukerjee, K., Customer Relationship Management-A Strategic approach to Marketing, 3rd Edition Prentice Hall of India, 2007. |

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

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|--------------------|----------------------------------|----------------------|--|
| Course Code | 17B1NHS731 | Semester:Odd | SemesterVII Session 2020 -2021 Month from July 2020 to Dec 2020 |
| Course Name | Customer Relationship Management | | |
| Credits | 3 | Contact Hours | 3-0-0 |

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

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

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

| | | | |
|---------------------------------|---|---|-----------|
| | | Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation. ***Dominos using different types of content to practice engagement | |
| 5. | Components of e CRM solutions (Overview) and Role of Digital Technologies | Data warehousing, Datamining and CRM, Market Basket Analysis and Retail sector, Campaign Management, Sales Force Automation, Customer Service and Support, Corporate Blogs, Online communities, Twitter, Wikis. The Experience ecosystem. CEM, Consumer engagement, segmentation and differentiation. ** Exercise on online campaign management solutions | 7 |
| 6. | Product offerings in the CRM Marketplace (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 inimplementing 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, SocialCustomer Insights, Social CRM Strategy, and Social Customer Analytics. * Excercise on Mckinsey's social media model | 5 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | MaximumMarks | |
| T1 | | 20 | |
| T2 | | 20 | |
| EndSemesterExamination | | 35 | |
| TA | | 25 | |
| Total | | 100 | |

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

| | |
|----|---|
| 1. | Customer Relationship Management, Ed. Peelan Rob Beltman, 2 nd Edition, Pearson, 2014. |
| 2. | Ou, Y. C., Verhoef, P. C., & Wiesel, T. The effects of customer equity drivers on loyalty across services industries and firms. <i>Journal of the Academy of Marketing Science</i> , 45(3), 336-356, 2017. |
| 3. | Lin, Y. C., Lee, Y. C., & Lin, S. Y. The influence of the personality traits of webcasters on online games. <i>International Journal of Electronic Customer Relationship Management</i> , 11(1), 94-103, 2017 |
| 4. | Menzel, C. M., &Reiners, T.Customer relationship management system a case study on small-medium-sized companies in north Germany. In <i>Information Systems for Small and Medium-sized Enterprises</i> pp. 169-197. Springer, Berlin, Heidelberg, 2014. |
| 5. | Customer Relationship Management-A strategic perspective, G. Shainesh, Jagdish Sheth, Reprinted Macmillan Publishers India Limited, 2009. |
| 6. | Mukerjee, K., Customer Relationship Management-A Strategic approach to Marketing, 3rd Edition Prentice Hall of India, 2007. |

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

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|------------------------|---|---|--|
| Subject Code | 17B2NCI735 | Semester Odd (specify Odd/Even) | Semester VII Session 2020_2021 Month from June 20 to Dec 20 |
| Subject Name | Advanced Databases | | |
| Credits | 4 | Contact Hours | 3-1-0 |
| Faculty (Names) | Coordinator(s) | Dr Devpriya Soni | |
| | Teacher(s) (Alphabetically) | Dr Devpriya Soni | |
| COURSE OUTCOMES | | | |
| | | | COGNITIVE LEVEL |
| C431-8.1 | Analyze concurrency control, transaction and recovery in data management. | | Analyze Level (Level 4) |
| C431-8.2 | Choose appropriate ways to optimize queries. | | Create Level (Level 6) |
| C431-8.3 | Apply queries in different forms (relational algebra, SQL, XQuery, CQL etc). | | Apply Level (Level 3) |
| C431-8.4 | Show understanding of modern data processing paradigms such as NoSQL and XML | | Remembering Level (Level 1) |
| C431-8.5 | Explain methods suitable for particular types of data such as temporal, multimedia or spatial data. | | Understanding Level (Level 2) |
| C431-8.6 | Develop and connect a sample web application with a given NOSQL database. | | Create Level (Level 6) |

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|-------------------|--------------------------------------|---|---------------------------------------|
| 1. | Refresher on databases and modelling | SQL: Data Definition and Data Manipulation, Relational Algebra, ER& EER Modelling | 2 |
| 2. | Stored Procedures and Triggers | Blocks of code stored and executed on the server, creating Triggers. | 2 |
| 3. | Transaction Management | Transactions Processing, ACID rules Concurrency Control, Recovery | 6 |
| 4. | Query Optimization | Data storage, Query processing and Techniques of optimization | 4 |
| 5. | Different Types of Data | Unstructured, Semi-Structured and Structured Data and their Storage Concerns | 2 |
| 6. | Data Storage and Retrieval Concerns | Motivation, characteristics and complexities of Data Storage and Data Retrieval, | 3 |
| 7. | Query Languages | Basics and Need of various Query Languages | 2 |

| | | | |
|-----|-------------------------------|---|-----------|
| 8. | Database security and privacy | Database security and privacy, including anonymisation and release | 6 |
| 9. | NoSQL Databases | NoSQL to relax ACID rules; consistency, availability, partition tolerance | 7 |
| 10. | XML Databases | XML, XPath and XQuery, XSLT, Integrating XML with Databases | 6 |
| 11. | Special purpose databases | Temporal, spatial, or multimedia databases | 2 |
| | | | 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) |
| Total | 100 |
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc) | |
| Text Books | |
| 1. | Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw-Hill, March 2019. |
| 2. | Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems (7th Edition) 7th Edition, Pearson Education (June 18, 2015), ISBN-10: 0133970779, ISBN-13: 978-0133970777. |
| Reference Books | |
| 1. | Thomas Connolly, Carolyn Begg, Database Systems-A Practical Approach to design, Implementation and Management, 3rd Edition, Addison-Wesley,2002. |
| 2. | NoSQL for Mere Mortals by Dan Sullivan. |
| 3. | Administering Oracle by Ivan Bayross |
| 4. | Handbook of Database Security: Applications and Trends, Editors: Michael Gertz, Sushil Jajodia, 2016. |

Lecture-wise Breakup

| | | | |
|------------------------|--|--|--|
| Course Code | 18B12CS314 | Semester odd (specify Odd/Even) | Semester VII Session 2020 -2021 Month from July 20 to Dec 20 |
| Course Name | Software Development and Management | | |
| Credits | 3 | Contact Hours | 4 |
| Faculty (Names) | Coordinator(s) | Dr Chetna Gupta | |
| | Teacher(s) (Alphabetically) | Dr Chetna Gupta | |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|---|-------------------------|
| CO1 | Compare and evaluate various analysis techniques to elicit, choose, negotiate and prioritize requirements. | Evaluate Level (C5) |
| CO2 | Apply logical and critical thinking to analyze, synthesize and apply risk management principles and processes to determine risk and its mitigation plans. | Evaluate Level (C5) |
| CO3 | Apply appropriate software design and modeling processes to specify, structure, model and validate requirements. | Apply Level (C3) |
| CO4 | Analyze design and code to find effective solutions to optimize performance of system by making changing in them. | Analyze Level (C4) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|---|--|---------------------------------------|
| 1. | Trends in Software Engineering Process | Overview of traditional life cycle models, History of Agile Methodologies, Extreme Programming, Scrum, User Stories, Agile Estimation & Planning, Tracking Agile Projects, Lean Software Development, Kanban, Agile Project Tools, Continuous Integration (CI), Agile Testing. | 5 |
| 2. | Software Systems Analysis | Balancing Development Needs with Organizational Expectations, Writing Requirements and Requirements Specifications, Quality Assurance of Requirements, Formal methods- Z, Prioritizing Requirements, crowd-centric RE, OOA and goal modeling, Connections and Alignment between Requirements Engineering and other Software Engineering activities. Study and analysis of various tools and techniques | 10 |
| 3. | Risk Assessment and management | Task Analysis, Accident Theory, Accident Investigation and Reporting, Accident Statistics, Safety Inspection Procedures, Disaster Planning, Risk Management Systems, Analysis of risk at various stages of SDLC, Tools and techniques | 5 |
| 4. | System Modeling | Domain Model Distinctions, steps, identify and organize concepts, conceptual model, documenting a domain model, code design process and principles. | 8 |
| 5. | Advanced Topics in SE | Cleanroom Software Engineering - Approach, functional specification, design and testing, Component based SE - CBSE process, domain engineering, component-based development, classifying and retrieving components, and economics of CBSE, Client/Server Software Engineering - Structure of client/server systems, software engineering for | 11 |

| | | | |
|---------------------------------|--|---|-----------|
| | | Client/Server systems, analysis modeling issues, design for Client/Server systems, testing issues, Building blocks for CASE, taxonomy of CASE tools, integrated CASE environments, integration architecture, CASE repository. | |
| 6. | Performance Engineering of Software Systems | Performance analysis, study of various tool and techniques to test various software systems. | 3 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | Maximum Marks | |
| T1 | | 20 | |
| T2 | | 20 | |
| End Semester Examination | | 35 | |
| TA | | 25 (Quiz, Assignment, Class Test, Class performance & attendance) | |
| Total | | 100 | |

| | |
|---|---|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Roger S. Pressman, “Software Engineering: A practitioner approach”, Fifth Edition-TMH International . |
| 2. | Sommerville , “Software Engineering” , Seventh Edition - Addison Wesley |
| 3. | GRADYBOOCH , JAMES RUMBAUGH , IVAR JACOBSON , The Unified Modeling Language User Guide , Addison Wesley, Reading, Massachusetts, May 2005 |
| 4. | Richard Thayer , “Software Engineering Project Management”, Second Edition - Wiley-IEEE Computer Society Press. |
| 5. | B. Bezier, “Software Testing Techniques”, Second Edition- International Thomson Computer Press. |
| 6. | Pankaj Jalote, “An Integrated Approach to Software Engineering” Third addition , Springer Press |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|-------------------|-----------------------|--------------------------------------|
| Course Code | 18B12CS434 | Semester (Odd) | Semester I Session 2020 -2021 |
| NBA Code | C431-3 | | Month from July - December |
| Course Name | Ethical Hacking | | |
| Credits | 04 | Contact Hours | (L+T) (3+1) |

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

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|-----------------|---|-------------------------------|
| C431-3.1 | Define what is ethical hacking and penetration testing, and when and why penetration testing is required along with testing phases. | Remember Level (Level 1) |
| C431-3.2 | Classify and outline the penetration testing phases and relate the phases to the specified context. | Understand Level (Level 2) |
| C431-3.3 | Identify and analyze the stages a penetration tester requires to take in order to compromise a target system. | Apply Level (Level 3) |
| C431-3.4 | Examine and implement tools and techniques to carry out a penetration testing. | Analyze Level (Level 4) |
| C431-3.5 | Critically evaluate security techniques used to protect system and user data to suggest countermeasures. | Evaluate Level (Level 5) |

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

| | | | |
|---------------------------------|-----------------------------|--|-----------|
| 11 | SQL Injection | SQL injection attacks and injection detection tools | 3 |
| 12 | Hacking WiFi and Bluetooth | Wireless Encryption, wireless hacking methodology, wireless hacking tools, and wi-fi security tools | 3 |
| 13 | Mobile Hacking and Security | Mobile platform attack vector, android vulnerabilities, jailbreaking iOS, windows phone 8 vulnerabilities, mobile security guidelines, and tools | 3 |
| 14 | IT Act 2008 | Indian Information Technology Act 2000 and IT Amendment Act 2008 | 4 |
| 15 | Pen testing Report | Various types of penetration testing, security audit, vulnerability assessment, and penetration testing roadmap | 2 |
| Total number of Lectures | | | 45 |

| Evaluation Criteria | |
|----------------------------|----------------------------------|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Quiz/project and Attendance) |
| Total | 100 |

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

Text Books

| | |
|----|--|
| 1. | Sean-Philip Oriyano, "Certified Ethical Hacker Version 9 - Study Guide", EXAM 312-50, Sybex Wiely, 2016. |
| 2. | Georgia Weidman, "Penetration testing A Hands-On Introduction to Hacking", No Scratch Press, 2014. |

Reference Books

| | |
|----|--|
| 3. | Raphaël Hertzog, Jim O’Gorman, and Mati AharoniKali, "Linux Revealed Mastering the Penetration Testing Distribution", OFFSEC Press, 2017 |
| 4. | Corey P. Schultz, Bob Perciancante, "Kali Linux Cook Book", Second edition, Packet Publishing, 2017. |
| 5. | Lee Allen, Tedi Heriyanto, Shakeel Ali, "Kali Linux – Assuring Security by Penetration Testing, Packet Publishing, 2014. |
| 6. | Deje, Murugan, “Cyber Forensics”, Oxoford University Press, 2018. |

NPTEL Courses
<https://nptel.ac.in/courses/106/105/106105217/>

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|-----------------------|--|---|
| Course Code | 18B12CS436 | Semester ODD (specify Odd/Even) | Semester VII Session 2020-2021 Month from July 2020- December 2020 |
| Course Name | Software Construction | | |
| Credits | 3-1-0 | Contact Hours | 4 |

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

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|-----------------|---|-------------------------------|
| C431-6.1 | Choose appropriate fundamental element of software construction for an actual software development. | Remembering Level (Level 1) |
| C431-6.2 | Apply various Assertion, Error-Handling, Exceptions techniques for defensive programming. | Apply Level (Level 3) |
| C431-6.3 | Make use of appropriate coding standards and conventions of code construction at class routines, variables, and statements level. | Apply Level (Level 3) |
| C431-6.4 | Experiment with code improvement strategies like Code Refactoring, Code Optimization and Tuning. | Apply Level (Level 3) |
| C431-6.5 | Demonstrate use of software construction techniques like parameterization, debugging and tools for GUI builders, unit testing , profiling, performance analysis and slicing . | Understanding Level (Level 2) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---------------------------------|---|---|--------------------------------|
| 1. | Fundamentals of software construction | What and Why Software Construction, Construction Decisions, Design in Construction, Software Metaphors use and importance, Code Quality, Managing Construction, Practical Considerations, Metaphors for Software development. | 3 |
| 2. | Code Construction | Design in Construction, Class Design and Working Classes, High-Quality Routines. Variables, Statements, Pseudo code Programming Process, limiting dependencies, Meta Programming | 9 |
| 3. | Defensive Programming | Protecting Your Program from Invalid Inputs, Assertion, Error-Handling, Exceptions, Protecting Code from damage caused by errors, Debugging Aids, Determining How Much Defensive Programming to Leave in Production Code | 6 |
| 4. | Code Improvements | Debugging, Code Refactoring, Code Optimization and Tuning strategies and techniques | 8 |
| 5. | Code Analysis | Tracing, Static and Dynamic analysis, identifying bad smells in code | 4 |
| 6. | Generic Programming and Scaling Code | Parameterization and Generics, Internationalization of code, Securing Code | 6 |
| 7. | Concurrency , synchronization and serialization in code | Implementing concurrency and serialization in code | 6 |
| Total number of Lectures | | | 42 |

| Evaluation Criteria | |
|---------------------|---------------|
| Components | Maximum Marks |
| T1 | 20 |

| | |
|---|--|
| T2 | 20 |
| End Semester Examination | 35 |
| TA(Tutorials regularity & Marco Assignments) | 25 (Assignments and Attendance) |
| | Attendance = 07 |
| | Internal assessment & Assignments in PBL mode = 18 |
| Total | 100 |

| | |
|--------------------------------------|---|
| Recommended Reading material: | |
| Text Books | |
| 1. | Clean Code Paperback – 1 January 2013 by Robert C Martin (Author) Pearson |
| 2. | The Pragmatic Programmer Addison Wesley; 2 edition (13 September 2019) |
| 3. | Refactoring: Improving the Design of Existing Code (Pearson Addison-Wesley Signature Series) Hardcover – 12 November 2018 |
| 4. | The Clean Coder Pearson Education (2013) |
| 5. | Clean Architecture: A Craftsman's Guide to Software Structure and Design January 2017 by Robert C. Martin (Author) |
| 6. | Java Concurrency in Practice Pearson Education India; First edition (29 September 2016) |
| 7. | Effective JAVA Pearson Education; Second edition (29 September 2016) |
| 8. | Mastering Concurrency Programming with Java 9, Second Edition January 2017 by Javier Fernandez Gonzalez (Author) |
| Reference Books | |
| 1. | Maguire, Steve, Writing Solid Code – Microsoft's Techniques for Developing Bug-Free C Software. Microsoft Press, 1993. |
| 2. | McConnell, Steve, Code Complete: A Practical Handbook of Software Construction. Microsoft Press, 1993. |
| 3. | Meyer, Bertrand, Object-Oriented Software Construction (Second Edition). Prentice-Hall, 1997. |
| 4. | Warren, Nigel, and Bishop, Philip, Java in Practice – Design Styles and Idioms for Effective Java. Addison-Wesley, 1999. |
| 5. | Fowler, Martin, Refactoring – Improving the Design of Existing Code. Addison-Wesley, 1999. |
| 6. | Writing solid code : Maguire, Steve. LeBlanc, David. Publisher: Bangalore WP Publishers & Distributors Pvt. 2001 |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|------------------------------|--|--|
| Course Code | 18B12CS437 | Semester Odd (specify Odd/Even) | Semester VII Session 2020 -2021 Month from July2020 to Dec 2020 |
| Course Name | Large Scale Database Systems | | |
| Credits | 3-1-0 | Contact Hours | 4 |

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

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

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

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

| | |
|----------------------------|---------------------------------|
| Evaluation Criteria | |
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Assignments and Attendance) |
| Total | 100 |

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

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

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

Detailed syllabus
Lecture-wise Breakup

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

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

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

| Evaluation Criteria | |
|----------------------------|---------------------------------------|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Assignment, Quiz, Oral Questions) |
| Total | 100 |

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

| | |
|----|---|
| 1. | Schultz, D. P., and Schultz, S. E., <i>Theories of personality</i> . Cengage Learning 11 th Ed., 2016. |
| 2. | Burger, Jerry M. <i>Personality: an introduction</i> . Cengage Learning, 10th Ed., Cengage Learning, 2019. |
| 3. | Mayer, John D. <i>Personality: A systems approach</i> . Rowman& Littlefield, 2017. |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|---------------------------------|----------------------------|---|
| Course Code | 18B12HS412 | Semester <u>Odd</u> | Semester <u>VII</u> Session 2020 -2021 Month from Aug 2020 - Dec 2020 |
| Course Name | HUMAN RESOURCE ANALYTICS | | |
| Credits | 3 | Contact Hours | 3-0-0 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|---|---|---------------------------------------|
| 1. | Introduction to Human Resource (HR) Analytics | Understanding the need for mastering and utilizing HR analytic techniques, Human capital data storage and 'big (HR) data' manipulation, Predictors, prediction and predictive modeling, Current state of HR analytic professional and academic training, HR's Contribution to Business Value, the Changing Nature of HR. | 8 |
| 2. | Human Resource information systems and data | Understanding HR metrics and data, Data collection, tracking, entry, Data availability in the entire Employment Lifecycle, Approaches and costs of collecting HR related data, Analysis software options, Using SPSS, Preparing the data. | 8 |
| 3. | Analysis Strategies | From descriptive reports to predictive analytics, Statistical significance, Data integrity, Types of data, Categorical variable types, Continuous variable types, Using group/team-level or individual-level data, Dependent variables and independent variables, Introduction of tools for HR data analysis: Correlation, Regression, Factor Analysis, Cluster Analysis, Structural equation modeling. | 10 |
| 4. | Application of Human Resource Analytics | Workforce Planning Analytics, Diversity Analytics, Talent Sourcing Analytics, Talent Acquisition Analytics, Talent Engagement Analytics, Training and Intervention Analytics, Analytical Performance Management, Retention | 10 |

| | | | |
|---------------------------------|------------------------------------|--|-----------|
| | | Analytics. | |
| 5. | Future of Human Resource Analytics | Rise of Employee Behavioral Data, Automated Big Data Analytics, Big Data Empowering Employee Development, Quantification of HR, Artificial Intelligence in HR. | 6 |
| Total number of Lectures | | | 42 |

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

| | |
|---|--|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Edwards and Edwards, Predictive HR Analytics. Mastering the HR Metric, Kogan Page, Limited, 2019 |
| 2. | Banerjee, Pandey and Gupta, Practical Applications of HR Analytics, Sage, 2019 |
| 3. | Bhattacharyya, HR Analytics: Understanding Theories and Applications, Sage, 2017 |
| 4. | Isson, Harriott and Jac Fitz-enz, People Analytics in the Era of Big Data: Changing the Way You Attract, Acquire, Develop, and Retain Talent, Wiley, 2016 |
| 5. | Guenole, Ferrar and Feinzig, The Power of People: How Successful Organizations Use Workforce Analytics To Improve Business Performance, First Edition, Pearson, 2017 |
| 6. | Sesil, Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing, Incentive and Improving Collaboration, Pearson, 2014 |

Detailed Syllabus
Lecture-wise Breakup

| | | | |
|---------------------|--|----------------------|---|
| Subject Code | 19B12BS422 | Semester Odd | Semester VII Session 2020-2021 Month from July 2020 to Dec2020 |
| Subject Name | Mathematical Foundations for Intelligent systems | | |
| Credits | 3-1-0 | Contact Hours | 4 |

| | | |
|------------------------|-----------------------|------------------------------------|
| Faculty (Names) | Coordinator(s) | Dr. Dhanalekshmi G |
| | Teacher(s) | Dr.ArchanaPurwar,Dr.Dhanalekshmi G |
| Sections | 1 | |

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

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|------------|---|--|--------------------------------|
| 1. | Application of Linear Algebra in intelligent systems | Introduction to linear algebra ; Data preparation using Linear Algebra in tabular and image datasets such as ^ one hot encoding and dimensionality reduction , ^ use of linear algebra notation and methods in sub-fields such as recommender systems. | 7 |
| 2. | Application of Probability and Information in intelligent systems | Introduction to Probability and entropy and its applications such as static and dynamic Bayesian network, Markov chain network | 6 |
| 3. | Optimization in intelligent systems | Unconstrained , constrained optimization ,convexity,Blackbox& Global OptimizationLangrange's function and its application such as Support Vector Machine etc.: | 12 |
| 4. | Application of Fourier Transformation in data analytics | Introduction, time series analysis, application of Fourier transform in data processing and analysis | 7 |
| 5. | Application of | Introduction to multivariate Calculus, use of calculus in intelligent applications such as | 10 |

| | | | |
|---------------------------------|-----------------------|---|-----------|
| | multivariate calculus | multivariate hyperbolic tangent neural network approximation, multivariate sigmoidal neural network approximation, deep learning NN | |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | Maximum Marks | |
| T1 | | 20 | |
| T2 | | 20 | |
| End Semester Examination | | 35 | |
| TA | | 25 (Assignments+Miniproject+attendance) | |
| Total | | 100 | |

| | |
|--|--|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| Text Books: | |
| 4. | Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. Mathematics for machine learning. Cambridge University Press, 2020. |
| 5. | Goodfellow, Ian, YoshuaBengio, and Aaron Courville. Deep learning. MIT press, 2016. |
| 6. | Bishop, C. M.: Pattern Recognition and Machine Learning. |
| 7. | Lecture Notes on Maths for Intelligent Systems Marc Toussaint |
| 8. | Strang, Gilbert. <i>Introduction to Linear Algebra</i> . 4th ed. Wellesley-Cambridge Press, 2009. ISBN |
| 9. | Multivariable Calculus with Applications Maria Shea Terrell and Peter Lax |
| Reference Books: | |
| 1. | Mitchell, Tom M. "Machine learning." (1997). |
| 2. | Bishop, Christopher M. Pattern recognition and machine learning. springer, 2006. |
| 3. | Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. The elements of statistical learning: data mining, inference, and prediction. Springer Science & Business Media, 2009. |
| 3. | Optimization for Machine Learning |

| | |
|----|---|
| | Suvrit Sra, Sebastian Nowozin and Stephen J. Wright |
| 4. | Learning with Kernels by Scholkopf and Smola (2000) |
| 5. | Duda, Hart, Stork: Pattern Classification. |
| 6. | Principle and Theory for Data Mining and Machine Learning by Clark, Forkoue, Zhang (2009) |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|----------------------------|--|---|
| Course Code | 19B12CS423 | Semester ODD (specify Odd/Even) | Semester VII Session 2020 -2021 Month from July 2020-Dec 2020 |
| Course Name | Computing for Data Science | | |
| Credits | 3-1-0 | Contact Hours | 3+1 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|--|---|---------------------------------------|
| 1. | Introduction to Data Science | Characteristics & Evolution of data, Data Science Process, Types & Levels of data, Datafication, Steps of Data Science, Central Tendency, Measure of Dispersion, Data Munging, Feature Engineering | 7 |
| 2. | Statistical Methods in Data Science | Data Distribution (Bernoulli, Uniform, Binomial, Normal, Poisson, Exponential), Mathematical Statistics, Inferential Statistics, Descriptive Statistics, Random Variable, Probabilistic Statistics, Sampling of data, Correlation Analysis | 7 |
| 3. | Computing techniques for Data Science | Regression, Mapping Problem to Machine Learning Task, Memorization Method, Generalized Additive Models, Time-Series Model, Predictive Modeling, Fuzzy C Means Clustering, Ensemble Techniques, Outlier Detection. | 10 |
| 4. | Technologies & Tools in Database Analytics | SQL Essentials for data science, String Pattern, Ranges, Sorting & Grouping Result Set, working with multiple tables, accessing database using R/Python, Database Text Analysis, User defined Functions & Aggregates, MADlib, Tools & Techniques for unstructured data. | 5 |

| | | | |
|---------------------------------|--|---|-----------|
| 5. | Statistical Methods for Evaluation | Hypothesis Testing, Difference of Means, Significance Level and P-Value, Test Statistics (Z-test, ANOVA, T-Test, 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 |
| Total number of Lectures | | | 42 |

| Evaluation Criteria | |
|---|-------------------------------|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA(Tutorials, regularity & Marco Assignments) | 25 (Assignments & Attendance) |
| (Attendance and Tut Performance = 07 | |
| Internal assessment & Assignment in PBL mode = 18) | |
| Total | 100 |

| Recommended Reading material: | |
|--------------------------------------|--|
| Text Books | |
| 1. | Haider, M. (2015). Getting Started with Data Science: Making Sense of Data with Analytics. IBM Press. |
| 2. | Dietrich, D. (Ed.). (2015). Data science & big data analytics: discovering, analyzing, visualizing and presenting data. Wiley. |
| 3. | Trevor, H., Robert, T., & JH, F. (2009). The elements of statistical learning: data mining, inference, and prediction. |
| Reference Books | |
| 4. | Grus, J. (2015). Data science from scratch: First principles with Python. " O'Reilly Media, Inc." |
| 5. | Taylor, J. K., & Cihon, C. (2004). Statistical techniques for data analysis. Chapman and Hall/CRC. |
| 6. | Shalev-Shwartz, S., & Ben-David, S. (2014). Understanding machine learning: From theory to algorithms. Cambridge university press. |
| 7. | Zumel, N., & Mount, J. (2014). Practical data science with R. Manning Publications Co.. |
| 8. | Saltz, J. S., & Stanton, J. M. (2017). An introduction to data science. SAGE Publications. |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|--|--|---|
| Course Code | 19B12CS424 | Semester ODD (specify Odd/Even) | Semester 7th Session 2020 -2021 Month from July-Dec 2020 |
| Course Name | Industrial Automation using Internet of Things | | |
| Credits | 4 | Contact Hours | 3-1-0 |

| | | |
|------------------------|--|-----------------|
| Faculty (Names) | Coordinator(s) | Dr. ChetnaDabas |
| | Teacher(s) (Alphabetically) | Dr. ChetnaDabas |

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

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

| | | | |
|---------------------------------|------------------------------|---|-----------|
| 6. | Low power Hardware devices | Low power Hardware devices, Upgradation of conventional M2M systems for IIoT, | 2 |
| 7. | IIoT Application Development | Difference between IIoT and consumer IoT Applications at technical level using case study (i) Food processing industries, (ii) Applications of UAVs in Industries (iii) Smart home appliances | 8 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |
| Components | | Maximum Marks | |
| T1 | | 20 | |
| T2 | | 20 | |
| End Semester Examination | | 35 | |
| TA | | 25 (Project +Assignment) | |
| Total | | 100 | |

| | |
|---|---|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| Text Book: | |
| 1. | Architectural Design Principles For Industrial Internet of Things by Hasan Derhamy |
| Reference Books: | |
| 2. | “Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress) |
| 3. | “Industrial Internet of Things: CybermanufacturingSystems”by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer) |
| 4. | Industrial IoT Reference Architecture document |
| 5. | Deploying IIoT sensors in the smart factory by Steve Taranovich |
| 6. | Introduction to Industry 4.0 and Industrial Internet of Things by Dr.SudipMisra |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|--------------------|---------------|--|---|
| Course Code | 19B12CS426 | Semester ODD (specify Odd/Even) | Semester VII Session 2020-2021 Month from July 2020- December 2020 |
| Course Name | IoT Analytics | | |
| Credits | 3-1-0 | Contact Hours | 4 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|------------|--|--|--------------------------------|
| 1. | Introduction to data analytics for IoT | An introduction to Data Analytics for IoT – Structured Versus Unstructured Data – Data in Motion Versus Data at Rest – IoT Data Analytics Overview – IoT data Analytics Challenges | 6 |
| 2. | Machine learning for IoT analytics | Machine Learning for IoT – Machine Learning Overview – Machine learning and getting Intelligence from IoT Big Data – IoT Predictive Analytics -Geographical Concepts and Spatial Technology for IoT – Deep Learning techniques | 10 |
| 3. | Big data platform for IoT analytics | Big Data Platform for IoT Analytics - Massively parallel processing databases- Azure Data Lake and IoT Hub, Node RED, Hadoop Ecosystem, Lambda Architecture- NoSQL Databases | 8 |
| 4. | Edge computing & fog computing For IoT analytics | Architecture of edge and fog computing - edge analytics core functions – distributed analytics systems - fog computing -big data metadata management – data lifecycle - data analytics at different fog layers –smart-health application | 7 |
| 5. | IoT network analytics | Flexible netflow Architecture – FNF components – Flexible netflow in Multiservice IoT Networks | 5 |

| | | | |
|----|------------------|---|-----------|
| 6. | Web enhanced IoT | Design layers, design complexity- Web Enhanced Building Automation Systems – Smart City Control and Monitoring – Smart Environment Monitoring | 6 |
| | | Total | 42 |

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

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

Course Description

| | | | |
|---------------------|------------------------|----------------------|--|
| Subject Code | CS427 | Semester | Semester VII Session 2018 - 19 Month from July '19 to Dec '19 |
| Subject Name | Introduction to DevOps | | |
| Credits | 3 | Contact Hours | 3 |

| | | |
|------------------------|-----------------------|-------------------------------------|
| Faculty (Names) | Coordinator(s) | Sulabh Tyagi |
| | Teacher(s) | 1. Sulabh Tyagi 2. Shariq Murtza |
| Sections | 1 | |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|---|----------------------------|
| C431-8.1 | Students will be able to understand the needs of Continuous integration, continuous delivery, continuous deployment and continuous monitoring. | Understand Level (Level 2) |
| C431-8.2 | Students will be able to create pull and push requests using GIT and GIT Hub and also able to review the changes on GitHub | Create Level (Level 6) |
| C431-8.3 | Students will be able to Write scripts for the creating pipeline and deploying the micro services for the Developed Application for the calculated load and response times. | Create Level (Level 6) |
| C431-8.4 | Students will be able to write scripts for the measuring and loading the reports in KAFKA and Tableau for management view. | Evaluate Level (Level 5) |

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|-------------------|-------------------------------|--|---------------------------------------|
| 1. | Introduction | Why DevOps? What is DevOps? DevOps Market Trends DevOps Engineer Skills DevOps Delivery Pipeline DevOps Ecosystem | 8 |
| 2. | Git, CI, CD, CDep, CM | Creating and merging different Git Branches Git workflows Git cheat sheet What is Continuous Integration? What is Continuous Delivery? What is Continuous Deployment? What is Continuous Monitoring? | 8 |
| 3. | Jenkins | Introduction to Jenkins (With Architecture) Jenkins Management Adding a slave node to Jenkins | 8 |

| | | | |
|---------------------------------|------------------|---|-----------|
| | | Building Delivery Pipeline 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 | |
| Total | | 100 | |

| | |
|---|---|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books | |
| 1. | <u>Practical DevOps</u> by Joakim Verona , 2017, Packt publishing |
| 2. | <u>Ansible: Up and Running, Automating Configuration Management and Deployment the Easy Way</u> by Lorin Hochstein, Rene Moser, 2017 |
| 3. | <u>DevOps: A Software Architect's Perspective</u> by Len Bass, Ingo Weber, Liming Zhu, 2018 |
| 4. | <u>Accelerate, The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations</u> by Nicole Forsgren, Jez Humble, Gene Kim, 2019 |

Text Books

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

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|------------------------|--|----------------------|--|
| Course Code | 17B1NPH732 | Semester: ODD | Semester: 7th Session: 2020 -2021 Month from July to December |
| Course Name | Nanoscience and Technology | | |
| Credits | 3 | Contact Hours | 3+1 |
| Faculty (Names) | Coordinator(s) | Navendu Goswami | |
| | Teacher(s) (Alphabetically) | Navendu Goswami | |

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

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

| | | | |
|---------------------------------|------------------------------|---|-----------|
| 5. | Application of Nanomaterials | Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High T _c nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS | 10 |
| Total number of Lectures | | | 40 |

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

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

| | |
|----|---|
| 1. | <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

| | | | | |
|---------------------|--|-----------------------|---|--|
| Subject Code | 17B1NPH731 | Semester : Odd | Semester: VII, Session : 2020-2021 Month from: July to December | |
| Subject Name | Introduction to Quantum Information Processing | | | |
| Credits | 03 | Contact Hours | 3+1 | |

| | | |
|------------------------|--|---------------------------------------|
| Faculty (Names) | Coordinator(s) | Prof Anirban Pathak and Dr Amit Verma |
| | Teacher(s) (Alphabetically) | Prof Anirban Pathak and Dr Amit Verma |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|---|-------------------------|
| C401-5.1 | Correlate Quantum Information Processing and their applications in quantum communication and computation. | Remembering (C1) |
| C401-5.2 | Explain quantum information, Qubit, quantum gates, and quantum circuits. Their applications in quantum computing, quantum cryptography and communications. | Understanding (C2) |
| C401-5.3 | Demonstrate the use of basic principles in solving various problems related to quantum circuits with the use of linear algebra and many algorithms and protocols. | Applying (C3) |
| C401-5.4 | Prove and estimate solution of numerical problems using physical and mathematical concepts involved with various quantum circuits. | Evaluating (C5) |
| C401-5.5 | Design of quantum circuits of desired output for quantum cryptography applications. | Creating (C6) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|--|---|---------------------------------------|
| 1. | Introduction | What is information? Why do we need to know how to manage the information growth? Is the information independent of physical laws used to store and process it? What is the present status of the subject and how far can we go? Definitions of classical information, Quantum information and their differences. | 3 |
| 2. | Thermodynamics and statistical mechanics | Introduction to thermodynamics; First and second law of thermodynamics; Microstates and Macro states; Entropy, Conditional entropy; Entropy as a measure of disorder (up to $S = k \ln(\omega)$) | 6 |
| 3. | Classical theory of information | Basic ideas of classical information theory, Measures of information (information content and entropy); Maxwell's Demon; Data compression; The binary symmetric channel; error correcting codes; Classical theory of computation; Universal computer; Turing machine; Computational complexity; Uncomputable functions; Shortcomings of classical information theory and necessity of information theory. | 8 |

| | | | |
|---------------------------------|------------------------------------|--|-----------|
| 4. | Introduction to quantum mechanics | Basic ideas of quantum mechanics; Probability interpretation; Measurement problem; Hilbert space; Schrodinger equation. | 8 |
| 5. | Quantum information | Quantum gates; No cloning theorem (Why quantum information can't be perfectly copied); Dense coding; Quantum teleportation; Quantum data compression; Quantum cryptography; The universal quantum computer; Universal gate; Church-Turing principle; Quantum algorithms; Simulation of Physical systems; Shor's factorization algorithm; Grover's search algorithm; Experimental quantum information processors; Quantum error correction. | 9 |
| 6 | Computers and Intelligent machines | Basic ideas of quantum computers and intelligent machines. | 4 |
| 7 | Summary | Summary of entire course and a short of introduction to the present goals of quantum information technology. | 2 |
| 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 Class performance (5 M)] |
| Total | 100 |

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

| | |
|----|---|
| 1. | Neil Gershenfeld, The Physics of information technology, Cambridge University Press. |
| 2. | H Hirvensalo, Quantum computing, Springer Verlag. |
| 3. | Lecture notes for Physics 229: Quantum Information and Computation, John Preskil http://www.theory.caltech.edu/people/preskill/ph229/#describe |
| 4 | Andrew steane, Quantum computing, Rep. Prog. Phys. 61, 117-173 (1998) or quant-ph/9708022 http://xxx.lanl.gov |
| 5 | P A M Dirac, The principles of Quantum mechnaics, Oxford University Press. |
| 6 | David J.C. MacKay, Information Theory, Inference and Learning Algorithm. |
| 7 | A. Barenco, Quantum Physics and Computers, Contemporary Physics, 37 , 375-89 (1996). |
| 8 | C.H. Bennett, Quantum Information and Computattion, Physics Today, Oct., 1995, 24-30 (1995). |
| 9 | A. Ekert, P. Hayden, H Inamori, Basic concepts in quantum computation, quant-ph/ 0011013. |
| 10 | D. Gottesman and H K Lo, From quantum cheating to quantum security, Physics Today, Nov., 2000. |
| 11 | J Preskill, battling decoherence: the fault – tolerent quantum computer. Physics Today, 24-30, June 1999. |
| 12 | A. M. Steane and W. Van Dam, Physicists triumph at guess my number, Physics Today, 35-39, Feb. 2000. |
| 13 | V. Vedral and M. B. Plenio, Basics of quantum computation, Prog. Quant. Electron, 22 1-39 (1998) |
| 14 | A. Zeilinger, Fundamentals of quantum information, Physcs World, 11, March, 1998. |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|------------------------|-----------------------------------|----------------------|--|
| Course Code | 16B1NPH732 | Semester: ODD | Semester: 7th Session: 2020 -2021 Month from July to December |
| Course Name | Green Energy and Climate Modeling | | |
| Credits | 3 | Contact Hours | 3+1 |
| Faculty (Names) | Coordinator(s) | Prashant Chauhan | |
| | Teacher(s) | Prashant Chauhan | |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|------------------------|---|-------------------------|
| C401-6.1 | Recall the basic information about different energy resources, reserves and define the problem with fossil fuel | Remembering (C1) |
| C401-6.2 | Explain green house effect, modelling of temperature measurement and physics behind the global warming | Understanding (C2) |
| C401-6.3 | Demonstrate the basic principles and designs of different solar collectors and concentrators, and identify the best design/material/location to absorb maximum solar energy | Applying (C3) |
| C401-6.4 | Analyze the potential of different renewable energy sources like wind, ocean and bio mass energy | Analyzing (C4) |
| C401-6.5 | Compare the output of renewable energy source using different design under different conditions/location | Evaluating (C5) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|-------------------|---------------------------------|---|---------------------------------------|
| 1. | Introduction | Man and energy, world and Indian production /reserve of conventional energy sources, alternative energy sources. | 02 |
| 2. | The greenhouse effect | Physics behind greenhouse effect, Blackbody radiation, layer model depending on energy flux and temperature at earth surface, radiation effect on Greenhouse gases, temperature structure of the atmosphere, Heat, pressure, wind, feedback mechanism. Carbon Cycle and Climate, Fossil Fuels, Effect of Conventional energy sources. | 10 |
| 3. | Solar energy | Nature and availability of radiation, estimation of solar energy radiation. Effect of receiving surface, location and orientation, heat transfer consideration relevant to solar energy, Characteristics of materials and surface used in solar energy absorption. Device for thermal collection and storage | 06 |
| 4. | Ocean Energy | Tidal energy, and its characteristics, tidal energy estimation, important component of tidal energy plant, single basin plant, double basin plant, turbine, tidal power plant development in India, wave energy, design parameters of wave energy plant, introduction and working of ocean thermal energy conversion, | 06 |
| 5. | Wind Energy and Bio Mass energy | Introduction to wind energy, Nature, power, forces, conversion and estimation. Components of wind energy system types, safety and environment, Introduction to bio mass energy, conversion and utilization of biogas plants and gasifiers | 10 |
| 6. | Fusion Energy | Basics of DT fusion, Magnetic confinement fusion, laser | 6 |

| | | | |
|---------------------------------|--|---|-----------|
| | | inertial fusion, present status of fusion reactors and future scope at international and national level | |
| Total number of Lectures | | | 40 |
| Evaluation Criteria | | | |
| Components | Maximum Marks | | |
| T1 | 20 | | |
| T2 | 20 | | |
| End Semester Examination | 35 | | |
| TA | 25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)] | | |
| Total | 100 | | |

| | |
|---|--|
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Global Warming : Understanding the forecast by David Archer, Wiley |
| 2. | Kothari D.P. renewable energy resources and emerging technologies, Prentice of India |
| 3. | G D, Non-conventional energy sources, Khanna Publishers |
| 4. | Duffie J A & Beckmann W A, Solar engineering of thermal process, Wiley-International Publication |

Detailed Syllabus

Lecture-wise Breakup

| | | | |
|------------------------|--|----------------------|--|
| Course Code | 20B12PH411 | Semester ODD | Semester 7th Session 2020 -2021 Month from July to December |
| Course Name | SUPERCONDUCTING MATERIALS, MAGNETS AND DEVICES | | |
| Credits | 3 | Contact Hours | 3+1 |
| Faculty (Names) | Coordinator(s) | Dr. Dinesh Tripathi | |
| | Teacher(s) (Alphabetically) | NA | |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|-----------------|---|-------------------------------|
| CO1 | Define unusual properties exhibited by superconducting materials and how these properties are important in the development of superconducting Devices. | Remember Level (Level 1) |
| CO2 | Explain the theories of superconductivity, the basic and operating parameters of superconductors, their classifications and design limitations for superconductor's applications-devices. | Understand Level (Level 2) |
| CO3 | Solve the various issues related to fabrication of superconducting wires, tapes, design of superconducting magnets and devices. | Apply Level (Level 3) |
| CO4 | Examine the potential use of low T _c and high T _c superconductors for designing both small and large scale applications. | Analyze Level (Level 4) |

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

| | | | |
|---------------------------------|-------------------------|---|-----------|
| | | Persistent switches, and superconducting magnet energization. | |
| 4. | Superconducting devices | Josephson junction in magnetic field, Superconducting Quantum Interference Devices (SQUIDS) and its applications, Superconductive Switches, Infrared detectors Superconducting energy storage system (SMES), Fault current limiters (SFCL), Maglev trains | 8 |
| Total number of Lectures | | | 40 |

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

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

Applied Numerical Methods (17B1NMA732)

Course Description

| | | | |
|--|---|--|---|
| Course Code | 17B1NMA732 | Semester - Odd | Semester VII Session 2020-21 Month from Aug 2020- Dec 2020 |
| Course Name | Applied Numerical Methods | | |
| Credits | 3 | Contact Hours | 3-0-0 |
| Faculty (Names) | Coordinator(s) | Dr Yogesh Gupta and Dr Neha Ahlawat | |
| | Teacher(s) (Alphabetically) | Dr Yogesh Gupta, Dr Neha Ahlawat, Dr. Pankaj Srivastava | |
| COURSE OUTCOMES | | | COGNITIVE LEVELS |
| After pursuing the above mentioned course, the students will be able to: | | | |
| C401-8.1 | solve a single and a system of non-linear equations and analyze the convergence of the methods. | | Applying Level (C2) |
| C401-8.2 | explain finite and divided difference formulae for numerical interpolation. | | Understanding Level (C3) |
| C401-8.3 | apply numerical differentiation and integration in engineering applications. | | Applying Level (C3) |
| C401-8.4 | solve a system of linear equations using direct and iterative methods with their applications in various engineering problems | | Applying Level (C3) |
| C401-8.5 | solve eigen-value and corresponding eigen- vector problem for a square matrix | | Analyzing Level (C4) |
| C401-8.6 | evaluate the solutions of initial and boundary value problems using various numerical methods. | | Evaluating Level (C5) |
| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
| 1. | Roots of Non-linear Equations | Concept of round-off and truncation errors. Iterative methods to find roots for one or more nonlinear equations with their convergence | 6 |
| 2. | Interpolation and Approximation | Interpolating polynomial, Lagrange formula with error, Formulae for equi-spaced points, Divided differences, Spline interpolation, Least square approximation | 7 |
| 3. | Numerical Differentiation and Integration | Approximation of derivatives, Newton-Cote's formulae, Gauss-Legendre quadrature formulae, Double integration | 7 |
| 4. | Numerical Linear Algebra | Gauss-elimination and LU-Decomposition Methods. Iterative methods: Jacobi and Gauss Seidel Methods and their convergence. Power's method for the largest eigen-value, Jacobi and Householder's methods for eigen-values of real symmetric matrices | 10 |
| 5. | Numerical Solutions of ODE and PDE | Runge-Kutta and predictor corrector methods for IVPs, Finite difference methods for BVPs, Shooting methods, Numerical solutions of parabolic and elliptic partial differential equations by Finite Difference Methods | 12 |
| Total number of Lectures | | | 42 |
| Evaluation Criteria | | | |

| Components | Maximum Marks |
|--|--|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Quiz, Assignments, PBL) |
| Total | 100 |
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Gerald, C.F. and Wheatley P.O. , Applied Numerical Analysis, 7 th Ed., Pearson Education, 2004. |
| 2. | Conte, S.D. and deBoor, C. , Elementary Numerical Analysis, 3 rd Ed., McGraw-Hill, 1980. |
| 3. | Gupta, R.S. , Elements of Numerical Analysis, 2 nd Ed., Cambridge University Press, 2015. |
| 4. | Jain, M.K., Iyengar, S.R.K. and Jain, R.K. , Numerical Methods for Scientific and Engineering Computation, 6 th Ed., New Age International, New Delhi, 2014. |
| 5. | Smith, G.D. , Numerical Solution of Partial Differential Equations, 2 nd Ed., Oxford, 1978. |

Generalized Fuzzy Set Theory with Applications (19B12MA412)

Course Description

| | | | |
|---------------------------------|--|---|---|
| Course Code | 19B12MA412 | Semester Odd | Semester VII Session 2020-21 Month from Aug 2020- Dec 2020 |
| Course Name | Generalized Fuzzy Set Theory with Applications | | |
| Credits | 3 | Contact Hours | 3-0-0 |
| Faculty (Names) | Coordinator(s) | Dr. Mohd. Sarfaraz | |
| | Teacher(s) (Alphabetically) | Dr. Mohd. Sarfaraz, Dr. Amit Srivastava | |
| COURSE OUTCOMES | | | COGNITIVE LEVELS |
| C401-21.1 | Apply the concept of Intuitionistic fuzzy sets in defining new information measures and in medical diagnosis and pattern recognition problems. | | C5 |
| C401-21.2 | Explain various hesitant fuzzy and generalized fuzzy operations. | | C2 |
| C401-21.3 | Describe various aggregation and generalized aggregation operators. | | C2 |
| C401-21.4 | Apply the concept of Pythagorean fuzzy sets in defining new information measures and in multiple attribute decision making (MADM) problems. | | C5 |
| C401-21.5 | Illustrate Fuzzy and possibility measures with evidence theory. | | C3 |
| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
| 1. | Intuitionistic fuzzy sets | Intuitionistic fuzzy sets (<i>IFSs</i>) – Basic definitions and operations. Measures of entropy, similarity and discrimination between Intuitionistic fuzzy sets (<i>IFSs</i>). Applications of <i>IFSs</i> in medical diagnosis and pattern recognition. | 10 |
| 2. | Hesitant fuzzy sets | Hesitant fuzzy sets – concepts, basic operations and basic properties. Extensions of hesitant fuzzy sets – Dual Hesitant fuzzy sets, Interval valued Hesitant fuzzy sets, Triangular Fuzzy Hesitant Fuzzy Sets, Hesitant Fuzzy Linguistic Term Sets. | 10 |
| 3. | Aggregation Operators | Aggregation Operators – concepts, basic operations and basic properties, weighted aggregation operators, Ordered weighted averaging operator, Induced ordered weighted averaging operator. | 8 |
| 4. | Pythagorean fuzzy sets | Pythagorean fuzzy sets - concepts, basic operations and basic properties, Hesitant Pythagorean fuzzy sets and their aggregation operators in multiple attribute decision making. | 8 |
| 5. | Dempster-Shafer Theory | Dempster-Shafer Theory as an alternative to Bayesian networks. Frame of discernment, Belief function, Plausibility and basic probability assignments. | 6 |
| Total number of Lectures | | | 42 |

| Evaluation Criteria | |
|---|---|
| Components | Maximum Marks |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25(Quiz, Assignments, PBL) |
| Total | 100 |
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Atanassov, Krassimir T. , Intuitionistic Fuzzy Sets -Theory & Applications, Springer, 1999. |
| 2. | Xu, Zeshui , Hesitant Fuzzy Sets Theory, Springer Verlag, 2014. |
| 3. | Bhargava, A. K. , Fuzzy Set Theory, Fuzzy Logic and Their Applications, S. Chand & Company Pvt. Ltd., 2013. |
| 4. | Cengiz Kahraman, Uzay Kaymak, Adnan Yazici , (Editors), Fuzzy Logic in Its 50th Yea New Developments, Directions and Challenges, Studies in Fuzziness and Soft Computing, Springer Verlag, Vol. 341, 2016. |
| 5. | Huchang Liao, Zeshui Xu , Hesitant Fuzzy Decision Making Methodologies and Applications, Uncertainty and Operations Research, Springer Verlag, 2017. |

