Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B1NHS731**	**Semester ODD**	**Semester 7th Session 2019 -2020 Month from July 2019 to December 2019**
Course Name	**DISASTER MANAGEMENT**		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr Nilu Choudhary
	Teacher(s) (Alphabetically)	Dr Nilu Choudhary

COURSE OUTCOMES		**COGNITIVE LEVELS**
C4O1-2.1	Understand disasters, their hazards and natural and social phenomena related to them.	Understanding level(C2)
C4O1-2.2	Analyse information on risks and relief	Analyzing level(C4)
C4O1-2.3	Make use of disaster management principles and community involvement methods in Disaster Risk Reduction.	Apply level(C3)
C4O1-2.4	Evaluate the role of different approaches and Humanitarian Assistance needed to manage pre and post- disaster periods	Evaluate level(C5)
C4O1-2.5	Formulate strategies for mitigation in future scenarios by applying technological innovations and learning lessons from past.	Creating level(C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Disasters**	Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks	4
2.	**Disasters: Types Of Disaster**	Natural and manmade disasters, their Impacts, Hazards.	4
3.	**Disaster :Caste, Class and Gender**	Caste and disaster, Disaster discrimination, Social class, Differential impacts of disaster - in terms of caste, class, gender, age location, Role of Women's in Disaster.	5
4.	**Approaches to Disaster Risk reduction**	Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness, community based DRR, Structural - nonstructural measures roles and responsibilities of community	5
5.	**Inter-relationship between Disasters and Development:**	Factors affecting Vulnerabilities, differential impacts, impact of appropriate technology and local resources.	5
6.	**Disaster Risk Management in India**:	Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, and Health	5
7.	**Risk Society**	Risk Society in 1992,Ulrick Beck, Processes of Modernization, The new paradigm of risk society	4
8	**Disaster Management Act(2005)**	DM Act and Policy, Other related policies, plans, programmes and Legislation).	2
9	**Global trends in disasters, Urban**	MDG and Disaster, Agenda 21: For Local actions, Global trends in disasters, urban disasters, pandemics, Epidemics,	4

	Disaster, Pandemics, Climatic Change and Complex Emergencies	complex emergencies, Climate change.	
10	**Disaster, Environment and Development**	Environment Management, Importance of Waste Management, Types of Disaster Waste, Sources of Waste	4
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Assignment, 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.	National Disaster Management Policy. Government of India, 2009.
2.	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi. 2011
3.	Indian Journal of Social Work. Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April. 2002
4.	Alexander David, Introduction in "Confronting Catastrophe", Oxford University Press, 2000
5.	Coppola P Damon, Introduction to International Disaster Management, Elsevier. 2007
6.	Ulrich Ranke, Natural Disaster Risk Management, Springer International Publishing, Edition 1, 2016.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS831**	**Semester: Odd (specify Odd/Even)**	**Semester: VII Session** 2019 -2020 **Month: July2019-Dec2019**
Course Name	Gender Studies		
Credits	3	**Contact Hours**	3-0-0

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

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

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introducing Gender Issues**	• Sex and Gender • Types of Gender • Gender Roles and Gender Division of Labor • Gender Stereotyping and Gender Discrimination • The Other and Objectification	8
2.	**Gender Perspectives of Body & Language**	• Biological, Phenomenological and Socio-Cultural Perspectives of body • Body as a Site and Articulation of Power Relations • Cultural Meaning of Female Body and Women's Lived Experiences • The Other and Objectification	8
3.	**Social Construction of Femininity** & **Feminism**	• Bio-Social Perspective of Gender • Gender as Attributional Fact • Feminine & Feminist • Major Theorists of Feminism Challenging Cultural Notions of Femininity • Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism & Cyber feminism • Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ;Cultural Feminism &	9

		Celebrating Womanhood • Analysis of role women have played across cultures	
4.	**Social Construction of Masculinity**	• Definition and Understanding of Masculinities • Sociology of Masculinity& its Types • Social Organization of Masculinity and Privileged Position of Masculinity • Politics of Masculinity and Power • Major Theorists of Masculinity • Masculine Identities in Literature, Cinema & Media.	9
5.	**Gender Sensitization Empowerment &Gender Inclusivity**	• Women , Law & Women Rights In India • From Women's Studies to Gender Studies: A Paradigm Shift • Gender Studies & Media: Creating New Paradigms in Gender & Culture	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Viva)
Total	**100**

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

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

Detailed Syllabus
Lecture-wise Breakup

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

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

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

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

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

Evaluation Criteria

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

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

1.	Research papers and online resources

Detailed Syllabus
Lecture-wise Breakup

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

Faculty (Names)	**Coordinator(s)**	Vibha Gupta
	Teacher(s) (Alphabetically)	Vibha Gupta

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

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	The concept of Stress - Major stressors vs. routine hassles ; Major types of Stressors - Occupational Stressors; Organization Stress; Environmental Stressors; Happy Interactive Class (HIC)	3
2.	Scientific Foundations of Stress	HIC 1, The Nature of Stress; Human Physiology; Stress and Relaxation Responses; Stress and Disease	5
3.	Body Systems activated by stressors	HIC2, Nervous System, Endocrine System, immune system, Cardiovascular system, Gastrointestinal System, Muscles	9
4.	Cognitive Psychology	HIC3, Theoretical models: psychodynamic, behavioral, and cognitive; Thoughts, Beliefs and Emotions: Behavioral Patterns; Self-concept and Self-esteem; Stress emotions - Anger and Fear; Personality Traits – Stress prone and Stress resistant	11
5.	Social Psychology	HIC4, Family and Culture; Demands and Responsibilities; Relationships; Verbal and Non-verbal Communication; Human Spirituality	3
6.	Stress and the Human Environmental Interactions	HIC4, Time; Body Rhythms; Weather and Climate; Nutrition; Exercise; Drugs and Addictions; Violence and Post Traumatic Stress	3
7.	Happy Interactive Class (HIC) related to Stress management 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

Department of Computer Science and Engineering & Information Technology,
JIIT, Noida

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NCI736	**Semester** ODD **(specify Odd/Even)**	**Semester** VII **Session** 2019 -2020 **Month from** July 2019
Course Name	Bioinformatics Algorithms		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Mr. Prantik Biswas
	Teacher(s) (Alphabetically)	Mr. Prantik Biswas

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-1.1	Relate to different computational challenges in Computational Molecular Biology.	Level-2
C432-1.2	Examine proper algorithmic concepts to solve a computational problem.	Level-4
C432-1.3	Determine the importance of traditional to contemporary approaches for solving the biological problems.	Level-5
C432-1.4	Design strategy to resolve real-world biological challenges.	Level-6
C432-1.5	Identify appropriate algorithmic technique to solve a given bioinformatics related task.	Level-3
C432-1.6	Develop an optimized solution model for computational biology problems.	Level-6
C432-1.7	Formulate prediction tools and estimate the solutions for biological problems.	Level-6

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Algorithms and Complexity	Introduction, Biological Algorithms versus Computer Algorithms, The Change Problem, Comparative Analysis of Various Classes of Algorithms.	2
2	Molecular Biology	Introduction, Structure of Genetic Materials, Structural Formation of Proteins, Information Passage Between DNA and Proteins, Evaluation of Bioinformatics.	3
3	Exhaustive Search	Restriction Mapping, Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, Profiles, Search Trees, Finding Motifs, Finding a Median String.	4
4	Greedy Algorithms	Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, Breakpoints: A Different Face of Greed, A Greedy Approach to Motif Finding.	3
5	Dynamic Programming Algorithms	Classical Problems: DNA Sequence Comparison, The Manhattan Tourist Problem, etc, Edit Distance and Alignments, Global Sequence Alignment, Scoring Alignments, Local Sequence Alignment, Alignment with Gap	7

		Penalties, Multiple Alignment, Gene Prediction, Statistical Approaches to Gene Prediction, Similarity-Based Approaches to Gene Prediction, Spliced Alignment.	
6	Divide-and-Conquer Algorithms	Divide-and-Conquer Approach to Sorting, Space-Efficient Sequence Alignment, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time.	4
7	Graph Algorithms	Graphs and Genetics, DNA Sequencing, Shortest Superstring Problem, DNA Arrays as an Alternative Sequencing Technique, Sequencing by Hybridization, SBH as a Hamiltonian Path Problem, SBH as an Eulerian Path Problem, Fragment Assembly in DNA Sequencing, Protein Sequencing and Identification, The Peptide Sequencing Problem, Spectrum Graphs, Protein Identification via Database Search, Spectral Convolution, Spectral Alignment.	8
8	Combinatorial Pattern Matching	Repeat Finding, Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms, Approximate Pattern Matching	4
9	Clustering and Trees	Hierarchical Clustering, k-Means Clustering, Evolutionary Trees, Distance-Based Tree Reconstruction, Reconstructing Trees from Additive Matrices, Evolutionary Trees and Hierarchical Clustering, Character-Based Tree Reconstruction	3
10	Applications	BLAST: Comparing a Sequence against a Database; The Motif Finding Problem, Gene Expression Analysis, Clustering and Corrupted Cliques, Small and Large Parsimony Problem, Hidden Markov Models, Randomized Algorithms	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (…)
Total	**100**

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

1	Jones, N. C., & Pevzner, P. (2004). *An introduction to bioinformatics algorithms*. MIT press.
2	Schölkopf, B., Tsuda, K., & Vert, J. P. (2004). *Kernel methods in computational biology*. MIT press.
3	Jiang, T., Xu, Y., & Zhang, M. Q. (2002). *Current topics in computational molecular biology*. MIT Press.
4	Pevzner, P. (2000). *Computational molecular biology: an algorithmic approach*. MIT press.
5	Gusfield, D. (1997). *Algorithms on strings, trees and sequences: computer science and computational biology*. Cambridge university press.
6	Lesk, A. (2013). *Introduction to bioinformatics*. Oxford University Press.
7	Gollery, M. (2005). Bioinformatics: Sequence and Genome Analysis, David W. Mount. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 2004, 692 pp., ISBN 0-87969-712-1. *Clinical Chemistry*, *51*(11), 2219-2219.
8	Cormen, T. H. (2009). *Introduction to algorithms*. MIT press.
9	*IEEE/ACM Transactions on Computational Biology and Bioinformatics*
10	*Bioinformatics* , https://academic.oup.com/bioinformatics

11	Nature Communications, http://www.nature.com/ncomms/

Module Coordinator: Dr. Suma Dawn & Dr. Taj Alam **Course Coordinator**: Mr. Prantik Biswas

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NHS731	**Semester: Odd**	**Semester** VII **Session** 2019 -2020 **Month from** July 2019 to Dec 2019
Course Name	Customer Relationship Management		
Credits	3	**Contact Hours**	3-0-0

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

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

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

		Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation.	
6.	Components of e CRM solutions (Overview) and Role of Digital Technologies	Data warehousing, Datamining and CRM, Market Basket Analysis and Retail sector, Campaign Management, Sales Force Automation, Customer Service and Support, Corporate Blogs, Online communities, Twitter, Wikis. The Experience ecosystem. CEM, Consumer engagement, segmentation and differentiation.	7
7.	Product offerings in the CRM Marketplace(Overview) and CRM Roadmap	Evaluating Technological solutions for CRM, Comparison of Siebel, Oracle, MySAP.com and People Soft Enterprise solutions, Comparison of Talisma, Sales logix, Microsoft and Sales notes for small and medium enterprises, Defining a CRM strategy, CRM Implementation Roadmap, Developing a relationship orientation, Customer centric marketing and processes, Building organizational capabilities through internal marketing, Issues in implementing a technology solution for CRM.	7
8.	Operational issues in implementing CRM,Social CRM	Process view of CRM, Budgeting for attraction vs. retention, Learning from customer defections, Customer Retention Plans, Evaluating Retention programs, Social Customer Relationship Management, Social Customer Insights, Social CRM Strategy, and Social Customer Analytics.	5
Total number of Lectures			**42**
Class Presentations			**6**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation , Class Test 1,Class Test 2, Attendance)
Total	**100**

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

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

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

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17B1NHS732**	**Semester :** Odd	**Semester** VII **Session** 2019 -2020 **Month from** July 2019 to Dec 2019
Course Name	Indian Financial System		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Mukta Mani(Sec62), Dr. Sakshi Varshney(Sec128)	
	Teacher(s) (Alphabetically)	Dr. Mukta Mani(Sec62), Dr. Sakshi Varshney(Sec128)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C401-1.1	Understand the inter-linkage of components of financial system and financial instruments of Money market and Capital market.	Understanding Level (C2)
C401-1.2	Analyze ways of fund raising in domestic and international markets	Analyzing Level (C4)
C401-1.3	Understand functioning of Stock market and evaluate securities for investment.	Evaluating Level (C5)
C401-1.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	Applying Level (C3)
C401-1.5	Apply knowledge of Income tax for calculation of tax liability of individual.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Meaning, Importance, and functions of Financial system. Informal and Formal financial system, Financial markets, Financial Institutions, Financial services and Financial instrument	4
2.	Money Market	Features of money market Instruments: Treasury bills, commercial bills, commercial papers, certificates of deposit, call and notice money, Functions of money market, Linking of money market with Monetary policy in India	5
3.	Capital Market	Features of Capital market instrument: Equity shares, Bonds. Fund raising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of Initial Public Offering-Intermediaries in IPO, Book building process and allotment of shares	6
4.	Foreign investments in India	Fund raising from foreign market through: Foreign direct investment and foreign institutional investment, American Depository Receipts, Global Depository Receipts, External Commercial Borrowings, and Private equity.	5

5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualization, broker, listing of securities, dematerialization, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	5
7.	Stock Valuation and Analysis	Investing basics: Consideration of Risk and Return, Stock Valuation and Analysis- Fundamental analysis: Economy, industry and company analysis; Technical Analysis of stocks using technical charts	6
8.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	4
9.	Overview of Income Tax	Basics of Income tax- Concept of previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- Salary, Allowances, Perquisites, Income from Capital Gain, Deductions under section 80C to 80U.	7
Total number of Lectures			**42**
Class presentations			**6**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation, class tests, Attendance)
Total	**100**

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

1.	Pathak Bharti V, *Indian Financial System*, 5th Edition, Pearson Education, 2018
2.	Madura Jeff, *Personal Finance*, 6th Ed, Pearson Education, 2017.
3.	Machiraju H R, *Indian Financial System*, 4th Ed, Vikas Publication, 2010
4.	Bhole L M, *Financial Institutions and Markets*, 4th ed. Tata McGraw Hill Publication, 2006.
5.	Singhania & Singhania, Students Guide to Income Tax, Taxmann Publication, 2019.
6.	*How to Stimulate the Economy Essay* [Online]Available: https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC
7.	Reserve Bank of India, 'Money Kumar & the Monetary Policy', 2007
8.	Ashiwini Kumar,Sharma,' De-jargoned: Book building process, Live Mint,2015.
9.	Madhavan, N. "Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?", Business Today, 28th June 2009.
10.	Kaul, Vivek, "Master Move: How Dhirubhai Ambani turned the tables on the Kolkata bear cartel", The Economic Times, July 1, 2011.

Detailed Syllabus
Lecture-wise Breakup

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

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

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

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Hours for the module**
1.	Conceptual Background of Human Rights and Social Justice	• Meaning and Concept of Human Rights & Social Justice • Notion and Classification of Rights: Natural, Moral and Legal Rights, • Concept of Civil Rights • Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights; Collective/Solidarity Rights), Distinction between CPR & ESCR	6

2.	Evolution of Human Rights	Human Rights in Middle Ages: • Magna Carta Modern Movement for Human Rights: • The United States Declaration of Independence • The French Declaration of the Rights of Man and the Citizen • United States Bill of Rights • Geneva Convention of 1864	9
3.	International Human Rights Standards	• Universal Declaration of Human Rights, 1948. • International Covenant on Civil and Political Rights, 1966 • International Covenant on Economic, Social and Cultural Rights, 1966	8
3.	Human Rights of the specially disadvantaged sections of the society	• Scheduled Castes/Scheduled Tribes and Other Backward Classes: Caste Prejudice and Discrimination • Minorities: Human Rights Issues of Ethnic minorities • Women and Children: Gender Discrimination, Domestic Violence and Offences against Women; Gender Sensitive Laws, Children: Child Abuse, Child Labour, Street Children • Aged and Disabled Persons: Vulnerability and social taboos	8
5.	Human Rights of the Working Class	• Migrant Workers • Bonded Labourers • Agricultural Labourers • Casual Workers	5
6.	Emerging Dimensions Of Human Rights	• National Sovereignty versus 'international enforcement' of human rights • International politics of human rights and selective application of international sanctions • Unilateral use of coercion and implementation of human rights • Human rights, and science and technology	6
Total number of Hours			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (assignment)
Total	**100**

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	**17B1NHS734**	**Semester** Odd	**Semester VII Session** 2019 -2020 **Month from** July to Dec 2019
Course Name	Managerial and Communication Skills		
Credits	3	**Contact Hours**	(3-0-0)

Faculty (Names)	**Coordinator(s)**	Dr. Deepak Verma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-3.1	Demonstrate understanding of basic aspects of business communication and realize the importance of it	Understand Level (C2)
C401-3.2	Assess one's and other's communication skills and adapt oneself in order to meet challenges at the competitive workplace	Evaluate Level (C5)
C401-3.3	Apply the appropriate conflict handling style for effective conflict management	Apply Level (C3)
C401-3.4	Demonstrate understanding about the opportunities and challenges of intercultural communication and recognizing cultural variations	Understand Level (C2)
C401-3.5	Apply the appropriate steps for better decision making by interpreting information	Apply Level (C3)
C401-3.6	Develop an understanding of professional ethics	Apply Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Communication Skill Assessment (CSA) & Development Plan	Build an overall understanding and expectations of the professional environment, Introspection and SWOT analysis of self, Gap Analysis, Guidelines for developing necessary skills and required knowledge to help students in their professional life, Strategies in the Job- Search process, Work on their personality profile and communication skills to make them ready to face the professional world	5
2.	Fundamentals and Functions of Business Communication	Definition and Importance of Business Communication, Communication requirements and characteristics of Managerial Communication, Interpersonal & Intrapersonal Business Communication	5
3.	Building Active Communication Skills	Writing for effect in business messages, Listening, Formal Speaking, Defensive and Non-Defensive Communication, Corporate Body language, Audio and Visual communication, Business Etiquettes and Mannerism	5
4.	Conflict Resolution and Negotiation skills	Origins of Conflict, Guidelines for Effective conflict management, Effective Negotiation in professional environment, Gaining leverage through Persuasion, Impasse	5

		and Alternative Dispute Resolution (ADR)	
5.	Corporate communication	Meeting Management: Need and Importance of Meetings, Conduct of Meeting, Public Relations : Meaning, Functions of PR Department, Roles and responsibilities of an Internal and External PR team, Corporate Social Responsibility	5
6.	Group Discussion and Interview Preparation and, Psychometric Tests	Introduction to the Job recruitment process, Criteria and methods of selection, Interview and GD concepts. Types of Interviews – Selection, Appraisal, Grievance, Exit, Preparing for an Interview, mock group discussion sessions, Psychometric Tests: Importance, Pattern & Practice sessions	5
7.	Data Interpretation and Decision making	Importance of Data Interpretation, Decision Making Techniques, Case Study: Approaches to solve , Reasoning: Interpretation Techniques	5
8.	Communicating Interculturally	Understanding the opportunities and challenges of Intercultural communication, Enhancing Intercultural sensitivity, Improving intercultural communication skills	5
9.	Ethics of Business Communication	Ethics, Fairness & Trust in Business Communication	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Discussion 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.	R.V. Lesikar, & M.E. Flatley, *Basic Business Communication Skills for Empowering the Internet Generation,* Tenth Edition, Tata McGraw Hill Publishing Company, 2005
2.	S. Sengupta, *Business and Managerial Communication*, Prentice Hall of India, 2011.
3.	A.C. Krizan, P. Merrier, J. Logan, & K. Williams, *Business Communication*, Eight Edition, Thomson South-Western, 2011.
4.	C.L.Bovee, J.V.Thill , *Business Communication Essentials: Fundamental skills for the Mobile-Digital-Social Workplace*, Eighth Edition, Pearson Education, 2018
5.	J. Higgins., *Ten skills for Effective Business Communication*, Tyco Pr, 2018
6.	M. Munter, L. Hamilton, *Guide to Managerial Communication*, Tenth Edition, Pearson, 2014

Detailed Syllabus
Lecture-wise Breakup

Course Code	**18B12HS412**	**Semester Odd**	**Semester VII Session 2019 -2020** **Month from July 2019 - December 2019**
Course Name	**HUMAN RESOURCE ANALYTICS**		
Credits	**3**	**Contact Hours**	**3-0-0**

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

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

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Human Resource (HR) Analytics	Understanding the need for mastering and utilizing HR analytic techniques, Human capital data storage and 'big (HR) data' manipulation, Predictors, prediction and predictive modeling, Current state of HR analytic professional and academic training, HR's Contribution to Business Value, the Changing Nature of HR.	8
2.	Human Resource information systems and data	Understanding HR metrics and data, Data collection, tracking, entry, Data availability in the entire Employment Lifecycle, Approaches and costs of collecting HR related data, Analysis software options, Using SPSS, Preparing the data.	8
3.	Analysis Strategies	From descriptive reports to predictive analytics, Statistical significance, Data integrity, Types of data, Categorical variable types, Continuous variable types, Using group/team-level or individual-level data, Dependent variables and independent variables, Introduction of tools for HR data analysis: Correlation, Regression, Factor Analysis, Cluster Analysis, Structural equation modeling.	10
4.	Application of Human Resource Analytics	Workforce Planning Analytics, Diversity Analytics, Talent Sourcing Analytics, Talent Acquisition Analytics, Talent Engagement Analytics, Training and Intervention 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.	Bhattacharyya, HR Analytics: Understanding Theories and Applications, Sage, 2017
2.	Pease, Byerly and Jac Fitz-enz, Human Capital Analytics: How to Harness the Potential of Your Organization's Greatest Asset, Wiley, 2012
3.	Isson, Harriott and Jac Fitz-enz, People Analytics in the Era of Big Data: Changing the Way You Attract, Acquire, Develop, and Retain Talent, Wiley, 2016
4.	Guenole, Ferrar and Feinzig, The Power of People: How Successful Organizations Use Workforce Analytics To Improve Business Performance, First Edition, Pearson, 2017
5.	Sesil, Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing, Incentive and Improving Collaboration, Pearson, 2014

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NPH732	**Semester: ODD**	**Semester: 7th Session:** 2019 -2020 **Month from July 19 to December 19**
Course Name	Nanoscience and Technology		
Credits	3	**Contact Hours**	3

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	Nanoelectronics, Nanobiotechnology, Catalysis by	10

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

Evaluation Criteria

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

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

1.	*Nanostructures and nanomaterials: synthesis properties and application*, Guozhong Cao, Imperial college press, London.
2.	*Introduction to nanotechnology,* Charles Poole *et al* J John Wiley & Sons, Singapore.
3.	*The Handbook of Nanotechnology: Nanometer Structures, Theory, Modeling, and Simulation,* A. Lakhtakia, Spie Press USA.
4.	*Springer Handbook of Nanotechnology,* Edited by B. Bhushan, Springer Verlag.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH732	**Semester: ODD**	**Semester: 7th Session:** 2019 -2020 **Month from July 19 to December 19**
Course Name	Green Energy and Climate Modeling		
Credits	3	**Contact Hours**	3

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 gas fiers	10
6.	Fusion Energy	Basics of DT fusion, Magnetic confinement fusion, laser inertial fusion, present status of fusion reactors and future scope at international and national level	6
		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	15B1NEC733	**Semester** ODD **(specify Odd/Even)**	**Semester** 7th **Session** 2019 -2020 **Month from** June 19 to Dec 19
Course Name	Fundamentals of Embedded Systems		
Credits	4	**Contact Hours**	3L+ 3T

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Verma (62)
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-4.1	**Understanding of the fundamental concepts for embedded systems design and complete architecture of the ATMEGA16/32 microcontroller.**	Understand [Level 2]
C431-4.2	**Identify various on chip peripherals of the ATMEGA16/32 microcontroller and make use of them for designing embedded applications.**	Apply [Level 3]
C431-4.3	**Experiment the basic concepts of embedded 'C' programming and make use of them in designing embedded system applications around various sensors and actuators.**	Analyzing [Level 4]
C431-4.4	**Understanding of the basic concept of RTOS, detailed study of ARM7 architecture (32 bit) and study of wireless protocols.**	Understand [Level 2]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fundamental for Embedded Developers.	Embedded System and its applications, Future Trends of Embedded System, Design Parameters of Embedded System and its significance, Microprocessor Versus Microcontrollers, Microcontrollers for Embedded Systems, Embedded Versus External Memory Devices, CISC Versus RISC Processors, and Harvard Versus Von-Neumann architecture.	4
2.	Detailed Study of AVR Microcontroller	ATmega16/32 Microcontroller (Basic architecture, Pin configuration, Memory organization (registers and i/o ports), Embedded C programming, Timers, on chip PWM, on chip ADC, Interrupts and Serial Communication.	10
3.	Concept of Embedded 'C' programming	Introduction to C, Difference between C and Embedded C, Data Types used in Embedded C, Arithmetic & Logical Operators, Control Flow, If & If – else, While & Do – while, For, Switch & Case, Continue & Break, Array & String, Functions and Header files, Pointers.	6
4.	Real World Interfacing with Microcontroller	Interfacing of single LED, Blinking of LED with timer and without timer, Interfacing of push-button and LED, Interfacing of 7-segment display, Interfacing of 8 push-buttons to control 7-segment display, Intelligent LCD Display, Interfacing of intelligent LCD display, Interfacing	12

		of Matrix Keyboard to control 7-segment display, ADC and DAC Modules, Interfacing of ADC0804, Interfacing with DAC0808, Different wave generation through DAC0808, Stepper Motor & DC Motor, Interfacing with stepper & DC motor, Different Sensor Interfacing, (IR Sensor, DTMF, Temperature Sensor)	
5.	Concept of RTOS and Advanced Microprocessor	Real Time Operating System (RTOS), Types of real time tasks, Task Periodicity, Process state diagram, Kernel and Scheduler, Scheduling algorithms, Shared data (Resource) and Mutual Exclusion, Semaphore, Introduction to ARM, Features, ARM Pipeline, Instruction Set Architecture (ISA), Thumb Instructions, Exceptions in ARM, Embedded Wireless Protocols (Infrared Data Association (IrDA), Bluetooth, IEEE 802.11).	10
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments & 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.	Muhammad Ali Mazidi, "The AVR microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education, 2008.
2.	Frank Vahid / Tony Givargis, "Embedded System Design", Willey India, 2002.
3.	Santanu Chattopadhyay, "Embedded System Design", 1st Edition, PHI Learning, 2010.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B19EC791	**Semester Odd (specify Odd/Even)**	**Semester** 7th **Session** 2019 -2020 **Month from** July 19 to Dec. 19
Course Name	Major Project-1		
Credits	4	**Contact Hours**	**0-0-0**

Faculty (Names)	**Coordinator(s)**	Sajai Vir Singh, Sharadha Saxena
	Teacher(s) (Alphabetically)	Archna Pandey,Varun Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
C450.1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding Level (C2)
C450.2	Analyze/ Design the skill for obtaining the optimum solution to the formulated problem with in stipulated time	Analyzing Level (C4)
C450.3	Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating Level (C 5)
C450.4	Develop the skill in student so that they can communicate effectively in both verbal and written form.	Create Level (C 6)

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Viva (V1)	20
End Term Viva (V2)	30
Day to Day	30
Project Report	20
Total	**100**

Detailed Syllabus

Course Code	15B19EC792	**Semester -:** Odd (specify Odd/Even)	**Semester-: 7th Session** 2019 -20 **Month- :** July - December
Course Name	**Term Paper**		
Credits	3	**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	**Dr. Dharmendra Kr. Jhariya, Dr. Bhagirath Sahu**
	Teacher(s)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C460.1	**Summarize the contemporary scholarly literature, activities and techniques for various domain of Electronics Engineering.**	**Understand Level (C2)**
C460.2	**Analyze the recent technology and research trends in Electronics and Communication.**	**Analyzing Level (C3)**
C460.3	**Develop the skill so that they can communicate effectively in both verbal and written form.**	**Applying Level (C4)**

Evaluation Criteria

Components	**Maximum Marks**
MIDSEMINAR	20
D2DP2MID	20
ENDSEMINAR	20
D2DUP2END	20
ENDREPORT	20
Total	**100**

Detailed Syllabus

Course Code	15B19EC793	**Semester -:** Odd (specify Odd/Even)	**Semester-: 7th Session** 2019 -20 **Month- :** July - December
Course Name	Summer Training Viva		
Credits	2	**Contact Hours**	Six weeks

Faculty (Names)	**Coordinator(s)**	Bajrang Bansal, Smriti Bhatnagar
	Teacher(s)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C455.1	Extend theoretical knowledge to real time Industry	Understanding Level (C2)
C455.2	Demonstrate the capacity for critical reasoning and independent learning	Understanding Level (C2)
C455.3	Make use of Industrial Training experience to prepare a scientific report	Applying Level (C3)
C455.4	Develop greater clarity about career goals in present condition	Applying Level (C3)

Evaluation Criteria

Components	**Maximum Marks**
Viva	25
Real world idea and knowledge of Industry	25
Report	25
Diary	25
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NEC734	**Semester** Odd	**Semester** VII **Session** 2019 -2020 **Month from** July to December
Course Name	RF and Microwave Engineering		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Jasmine Saini
	Teacher(s) (Alphabetically)	Prof. Shweta Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-5.1	Explain the concepts of microwave circuits and scattering parameters.	Understanding (C2)
C431-5.2	Evaluate the performance of several waveguide components and determine their responses and applications.	Evaluating (C5)
C431-5.3	Analyze the behaviour of microwave sources based on solid state devices and tubes at microwave frequencies.	Analyzing (C4)
C431-5.4	Determine mearurent parameters of microwave components and understand the ISM applications of Microwave Energy.	Applying (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to RF and Microwave Engineering	History of Microwaves, applications of Microwaves, Maxwell's Equations.	2
2.	Microwave Transmission Lines	Review of Transmission lines, Line Equations. Microwave Integrated Lines: Microstrip line, Strip line, CPW line.	3
3.	Impedance matching	λ/4 Transformer, Tapered Lines :Exponential	3
4.	Scattering Parameters	S-parameters: definition, properties, 2-port, 3-port and 4-port.	4
5.	Microwave Components	H-plane, E-plane and Magic Tee, Isolator, Circulator, Directional Coupler, Cavity Resonators, Q of Cavity Resonator, Rectangular waveguide cavities.	10
6.	Microwave Devices and Sources	Microwave semiconductor devices, Schottky diode, Gunn diode, Microwave Tubes.	7
7.	Microwave Measurements	Impedance and Power Measurement Vector Network Analyzer, Spectrum analyzer.	4
8.	RF Filters	Classification of filters, Filter Design by Insertion loss method	3

9.	Microwave Propagation and Applications	Industrial, Scientific and Medical applications of Microwave Energy, Biological effects of microwave energy.	4
		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.	D.M. Pozar, Microwave Engineering (2nd Ed.), John Wiley, 1998.
2.	S.Y. Liao, Microwave Devices and Circuits (3rd Ed.), Pearson, 2003.
3.	Peter A. Rizzi, Microwave Engineering, Pearson, 1998.
4.	B. R. Vishvakarma , R. U. Khan and M.K. Meshram , Microwave Circuit Theory and Applications, Axioe Books, 2012.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**17B1NEC735**	**Semester Odd**	**Semester** 7th **Session** 2019-20 **Month from** Jul 19 to Dec 19
Subject Name	**Information Theory and Applications**		
Credits	**4**	**Contact Hours**	**3+1**

Faculty (Names)	**Coordinator(s)**	Dr. Neetu Singh
	Teacher(s) (Alphabetically)	Dr. Neetu Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-5.1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understanding [Level 2]
C430-5.2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analysing [Level 4]
C430-5.3	Analyze the relationship between bandwidth and capacity of communication channels and its importance in real life communication systems.	Analysing [Level 4]
C430-5.4	Analyze the need for channel coding in digital communication systems.	Analysing [Level 4]
C430-5.5	Generate error correcting codes for error detection and correction.	Analysing [Level 4]

Module No.	**title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of Basic Probability	Probability spaces. Random variables. Distributions and densities. Functions of random variables. Statistical Averages. Inequalities of Markov and Chebyshev. Weak law of large numbers.	3
2.	Information Measure	Discrete entropy. Joint and conditional entropies. Entropy in the continuous case. Maximization of continuous entropy. Entropy of a bandlimited white Gaussian process.	5
3.	Data Compression	Uniquely decipherable and instantaneous codes. Kraft- McMillan inequality. Noiseless coding theorem. Construction of optimal codes.	4
4.	Data Transmission	Discrete memoryless channel. Mutual information and channel capacity. Shannon's fundamental theorem and its weak converse. Capacity of a bandlimited AWGN channel. Limits to communication – Shannon limit.	5
5.	Error Control Coding	Coding for reliable digital transmission and storage. Types of codes. Modulation and coding. ML decoding. Performance measures.	3
6.	Linear Block Codes	Algebra Background, Groups, Fields, Binary field arithmetic. Vector Spaces over GF(2). Generator and parity check matrices. Syndrome and error detection. Standard array and syndrome decoding. Hamming codes.	8

7.	Cyclic Codes	Polynomial representation, Systematic encoding. Cyclic encoding, Syndrome decoding.	6
8.	Convolutional Codes	Generator Sequences. Structural properties. Convolutional encoders. Optimal decoding of convolutional codes- the Viterbi algorithm.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Performance. Assignment/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.	R.B. ASH: Information Theory, Dover, 1990.
2.	R. BOSE: Information theory, coding and cryptography, Macgraw Hill 2016.
3.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2010.
4.	S. LIN & D.J. COSTELLO: Error Control Coding, 2nd Edn, Pearson, 2011.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B1NEC736	**Semester:** ODD	**Semester**: 7th **Session** 2019 -20 **Month from** July 19 **to** December 19
Subject Name	Essentials of VLSI Testing		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shamim Akhter
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-4.1	Understand the fundamental of Digital System testing	Analyzing Level (C4)
C430-4.2	Analyze Stuck-at faults model and Fault Simulation algorithms	Analyzing Level (C4)
C430-4.3	Perform Combinational and Sequential ATPG	Evaluating Level (C5)
C430-4.4	Analyze Controllability and Observability of Combinational and Sequential circuits	Analyzing Level (C4)
C430-4.5	Understand Design for Testability (DFT), Built-In-Self-Test(BIST), and Test Vector Compression	Analyzing Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to VLSI Testing	Types of tests, Test Process and Equipments, Automatic Test Equipment, Fault coverage, Defect level	5
2.	Fault Modeling	Stuck-at faults, Fault equivalence & dominance, Logic and Fault Simulation	8
3.	Testability measures	Controllability & Observability for Combinational and Sequential circuits, SCOPE algorithm	7
4.	Testing algorithms for Combinational & sequential circuits	Combinational ATPG, D-algorithm, PODEM, FAN, Sequential ATPG algorithms	12
5.	Design For Testability and BIST Architecture	Introduction to Design for Testability (DFT), Scan Test, Built-In-Self-Test, Test Compression Techniques	11
		Total number of Lectures	**43**

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.	M.L. Bushnell and V.D. Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits, 1st Edition, Springer, 2013, **[TEXTBOOK]**
2.	Alexander Miczo, Digital Logic Testing and Simulation, 2nd Edition, John Wiley & Sons, 2003
3.	Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, VLSI Test Principles and Architectures, 1st Edition, Morgan Kaufmann, 2006.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B1NEC738	**Semester:** ODD	**Semester: 7th** **Session: 2019-2020** **Month from: Jan 19 to Dec 19**
Subject Name	Radar Signals and System		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	ABHAY KUMAR	
	Teacher(s) (Alphabetically)	ABHAY KUMAR	

COURSE OUTCOME		**COGNITIVE LEVELS**
C430-9.1	Demonstrate the basic principle of RADAR System.	Understanding [Level II]
C430-9.2	Solve the Radar equations and find out the transmitted and received power	Applying [Level III]
C430-9.3	Analyze the working principle of CW, Frequency Modulated, MTI and Pulsed Radar	Analyzing [Level IV]
C430-9.4	Analyze the Radar Signal and its detection in noise with the concept of Matched filter	Analyzing [Level IV]
C430-9.5	Analyze the applications of Radar in tracking and Imaging, Guided Missile and Aircraft Navigation.	Analyzing [Level IV]

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	**a. Radar fundamentals (Basic)**	Basic, Principle of operation, Radar Classification with application, Radar Block Diagram, Range, Radar transmitting signals duty cycle, Unambiguous range, Range Resolution, Target velocity calculation using Doppler shift and Doppler Frequency, Coherence	4
2.	**b. Radar fundamentals (Advance)**	Radar Equation, Minimum Detectable signal, Receiver Noise, Probability-density function and its type, SNR, Integration of Radar Pulses and improvement factor, Radar Cross Section of targets, Transmitter power, PRF, Radar equations for low and high PRF, Antenna Parameters, System Losses, Propagation Effects.	6
3.	**Continuous wave radar (CW)**	Functional Block Diagram, CW Radar Equation, Frequency Modulation, Linear FM (LFM) CW Radar, Multiple Frequency CW Radar	3
4.	**Moving target indication radar(MTI)**	MTI Radar Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator	4

		Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI	
5.	**Pulsed radar**	Pulsed Radar, Pulsed radar block diagram, Range and Doppler Ambiguities, Resolving Range Ambiguity, Resolving Doppler Ambiguity, MTI versus Pulse Doppler Radar.	3
6.	**Radar signal analysis**	Low Pass, Band Pass signals and Quadrature Components, CW and Pulsed waveforms, LFM waveforms, High Range Resolution, Stepped Frequency Waveforms	3
7.	**Radar signal detection in noise**	Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise	3
8.	**Tracking and Imaging radar**	Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers. Introduction to synthetic Aperture Radar	7
9.	**Radar Application-Guided missiles**	Guided missiles; Classifications; Description of tactical missiles. Guidance phases during flight; Categories of Homing and command guidance. The kinematic equations. Missile Guidance laws; Classification of guidance laws; Classical guidance laws; Modern guidance laws.	4
10.	**Radar Application-Aircraft Navigation**	Aircraft Navigation; Kinds of navigation – Position Fixing and Dead-reckoning systems. LORAN; DECCA; OMEGA. Very High Frequency Omni-Directional Range (VOR). Celestial navigation and GPS based navigation; Inertial Navigation Systems. Integrated navigation systems.	3
		Total number of Lectures	40

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35

TA	25
Total	**100**

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	Introduction to radar system, Merril I. Skolnik, III rd Edition, McGraw-Hill 2008
2.	Radar system analysis and design using MATLAB, Bassem R. Mahafza, IIIrd Edition CRC Press 2015
3.	R.J Sullivan, Radar foundation for imaging & advanced concepts, PHI, 2004.
4.	Mark A Richards, Fundamentals of Radar Signal Processing, McGrah -Hill Company, 2005
5.	M. Kayton and W. Fried: Avionics Navigation System, Wiley Interscience, 1997.
6.	Paul Zarchan: Tactical and Strategic Missile Guidance, AIAA, 2012.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NEC742**	**Semester: Odd (specify Odd/Even)**	**Semester** 7th **Session** 2019-2020 **Month** from July to Dec
Subject Name	Introduction to data analysis with R		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Kapil Dev Tyagi
	Teacher(s)	Kapil Dev Tyagi

S. NO.	DESCRIPTION	COGNITIVE LEVEL
C430-2.1	Identify continuous/discrete probabilistic models for a given random variable distribution	Applying Level (C3)
C430-2.2	Test for hypothesis using statistical tests like z-test, t-test ANOVA etc.	Analyzing Level (C4)
C430-2.3	Explain unsupervised and supervised machine learning algorithms	Understanding Level (C2)
C430-2.4	Utilize software in Matlab/R languages for implementation of ANOVA, Regression, and Machine learning techniques	Applying Level (C3)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	**Software**	Introduction to R and MATLAB programming for data analysis.	4
2.	Probabilistic models	Probabilistic models: Events and their probabilities, Rules of probability, Conditional probability and independence, Distribution of a random variable, Expectation and variance, Families of discrete distributions, Families of continuous distributions	10
3.	Statistics	Descriptive statistics, Inferential statistics, Hypothesis testing and estimation (z-test, t-test, proportional z-test) ANOVA, Regression	12
4.	Machine Learning	Introduction to Unsupervised and Supervised machine learning algorithms like ordinary least squares method, k-NN technique, Logistic regression etc.	8
5.	Simulations of data analysis techniques	Detailed simulation of ANOVA, Regression, and Machine learning techniques in Matlab/R languages.	5
6.	Data smoothing (optional)	Introduction to smoothing functions.	3

		Nonparametric smoothing, functional linear models, dimensional reduction functional principle components analysis.	
Total number of Lectures			**42**
Evaluation Criteria **Components** **Maximum Marks** T1 20 T2 20 End Semester Examination 35 TA 25 **Total** **100**			

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Anil Maheshwari, Business Intelligence and Data Mining Made Accessible, Createspace Independent Pub, 2014.
2.	Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Revised and Updated, John Wiley & Sons, 2016.
3.	Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.
4.	https://www.datacamp.com/courses/free-introduction-to-r
5.	https://onlinecourses.science.psu.edu/statprogram/r
6.	http://www.iiserpune.ac.in/~ayan/MTH201/Sahoo_textbook.pdf

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B11EC731**	**Semester ODD**	**Semester** 7th **Session** 2019 -2020 **Month from** July **to** Dec
Subject Name	Mobile Communication		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Alok Joshi, Juhi
	Teacher(s) (Alphabetically)	Alok Joshi , Ankur Bhardwaj ,Bajrang Bansal , Juhi , Neeti Singh, Prakash Kumar Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C410.1	Explain the evolution of mobile communication and basics of all the wireless standards currently being employed.	Understanding Level (C2)
C410.2	Perform mathematical analysis of cellular systems and cellular capacity improvement designs.	Analyzing Level (C4)
C410.3	Analyze large and small scale propagation models and their design both mathematically and conceptually. Analysis of various fading models.	Analyzing Level (C4)
C410.4	Analyze architecture of 2G, 3G and 4G systems and issues associated with them. Formulate research problems based on the issues associated with 4G systems.	Analyzing Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Mobile communication system evolution	Evolution of mobile communication systems. 2G, 3G, and 4G systems. Block diagram of mobile communication system. Problems of mobile communication: spectrum, propagation. Near far problem.	3
2.	The cellular Concept – System Design Fundamentals	Introduction, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage & capacity in cellular system	8
3.	Mobile Radio Propagation	Free Space Propagation Model, Ground Reflection Model, Small scale Propagation, Impulse Response model of a multipath channel, Parameters of mobile multipath channels, Types of small scale fading, Rayleigh and Ricean distributions, Level crossing rates and Average fade duration.	12
4.	Multiple Access Techniques	FDMA, TDMA, CDMA and OFDMA techniques and their performance. Number of channels.	5
5.	Mobile communication network architectures	GSM**:** GSM standards and architecture, GSM Radio aspects, typical call flow sequences in GSM, security aspects. GPRS, UMTS.	8

6	Introduction to 4G systems	Long Term Evolution (LTE) and Worldwide Interoperability for Microwave Access (WiMax).	4
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/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.	**T. S. Rappaport, Wireless Communications (principle and practice), PHI/Pearson, 2002.**
2.	William C.Y. Lee, Mobile Cellular Telecommunications- Analog & Digital Systems, Mc.Graw Hill, 1995
3.	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
4.	V.K.Garg, Principles and Applications of GSM, Pearson Education, 1999
5.	V.K.Garg, IS-95 CDMA and CDMA 2000, Pearson Education, 2000

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17B11EC733	**Semester: ODD**	**Semester: 7th Session : 2019-20** **Month : from July to December**
Subject Name	OPTICAL COMMUNICATION		
Credits	4	**Contact Hours**	3(L)+1(T)

Faculty (Names)	**Coordinator(s)**	Dr. Rahul Kaushik
	Teacher(s) (Alphabetically)	Dr. Rahul Kaushik

S. No.	Course Outcomes	Cognitive Levels
C430-8.1	Develop an understanding of optical fiber, its structure, types, and propagation and transmission properties.	Remembering (Level I)
C430-8.2	Identify and examine the different kinds of losses and signal distortion in optical Fibers.	Analyzing (Level IV)
C430-8.3	Classify the Optical sources and detectors and their principle of operation.	Understanding (Level II)
C430-8.4	Design a fiber optic link based on budget analysis.	Evaluating (Level V)

Module No.	Subtitle of the Module	Topics	No. of Lectures
1.	Overview of Optical fiber Communications	Electromagnetic Spectrum, Historical development and advantages of optical fiber communication, Elements of optical fiber transmission link, Optical laws and definitions, optical fiber modes and configurations.	3
2.	Optical fibers Structures	Optical fiber wave guides, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical fibers Modes, V Number, Mode Coupling, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index.	4
3.	Signal Degradation in	Signal distortion in optical fibers-	7

	Optical fibers	Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity, Group delay, Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, Intermodal dispersion, Pulse broadening. Optical fiber Connectors- Connector types, Single mode fiber connectors, Connector return loss.	
4.	Optical Sources	Light emitting diode (LEDs)-structures, materials, Figure of merits, Quantum efficiency, Power, Modulation, Power bandwidth product. Laser Diodes - Modes & threshold conditions, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, temperature effects, external quantum efficiency, and laser diode rate equations. Reliability of LED & ILD.	6
5.	Power Launching and Coupling	Source to fiber power launching: - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, LED coupling to single mode fiber. Fiber Splicing- Splicing techniques, splicing single mode fibers. Multimode fiber joints and single mode fiber joints. Fibre alignment and joint loss.	6
6.	Photo detectors& Receivers	Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation:- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.	7
7.	Optical System Design	Considerations, component choice, multiplexing.Point-to- point links, System considerations, Link considerations. Overall fiber dispersion in multi mode and single mode fibers.	9

		Rise time considerations. Distance consideration in optical transmission system. Line coding in Optical links, WDM Principles & Types of WDM, Measurement of Attenuation and Dispersion, Eye pattern. Introduction to FSO, VLC, Li-fi	
			Total number of Lectures 42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading(Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.
2.	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
3.	D.K. Mynbaev,S.C. Gupta and Lowell L. Scheiner,Fiber Optic Communications,Pearson Education, 2005.
4.	Govind P. Agarwal, Fiber Optic Communication Systems, 3rd Edition, John Wiley, 2004.
5.	Joseph C. Palais, Fiber Optic Communications, 4th Edition, Pearson Education, 2004

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC420	**Semester Odd (specify Odd/Even)**	**Semester** 7th **Session** 2019 -2020 **Month from July** to Dec
Course Name	**Smart and Sustainable Systems**		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Vinay Anand Tikkiwal
	Teacher(s) (Alphabetically)	Vinay Anand Tikkiwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-6.1	Explain the motivation for sustainable systems; implementation challenges and policy initiatives. Understand the basics of smart systems including sensors, sensor network integration, Internet of Things (IOT). Illustrate the role of smart technologies in implementing sustainable systems.	Understanding (C2)
C431-6.2	Understand the basics of renewable sources of energy and fundamentals of smart grids. Analyzing the role of renewable energy in sustainable systems.	Analyzing (C4)
C431-6.3	Illustrate the concept of sustainable urban infrastructures. Application of electronic and digital technologies to urbanization issues, smart urban transportation: electric vehicles (EVs).	Analyzing (C4)
C431-6.4	Understand the role of ICTs in reducing GHG emissions, green data centers, and energy efficient wireless and wired communications.	Understanding (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Motivation for sustainable systems, requirements, implementation challenges. Introduction to smart systems and their role in implementing sustainable systems.	3
2.	Smart Systems	Basics of Sensors, Actuators and Controllers, Sensor network integration, IOT, Smart Integrated systems.	6
3.	Green Energy	Fundamentals of renewable energy. Hybrid Energy Systems: configurations, design and optimization techniques.	8
4.	Smart Grids	Communication in power systems, smart grid technologies, grid integration, issues in grid integration, smart grid policy and regulation.	7
5.	e-Mobility	Basics of Electric Vehicles, Vehicle Types, EV infrastructure: Hardware; Specifications, Policies, Feasibility analysis, Infrastructural Issues, Economics of EV, Prospects in India.	7
6.	Smart Cities	Green Construction, Zero-Energy buildings, Smart urban	6

		transportation and Smart urban energy systems, Electronic and Digital Technologies, Instrumentation intelligence, Transition issues, Policies, Smart Cities Mission, India.	
7.	Green ICT	ICTs for sustainable development, Introduction to Green ICT Strategies, Green data centers, Energy efficient wireless and wired communications, recycling of ICT equipment, energy harvesting and CO_2 capturing methods.	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

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

1.	Lin, Y.-L., Kyung, C.-M., Yasuura, H., Liu, Y (Eds.), *Smart Sensors and Systems*, Springer, 2015.
2.	Kamal, R., *Internet of Things Architecture and Design Principles*, 1st. Ed., Chennai, McGraw Hill Education (India), 2017.
3.	Kothari, D.P., Singal, K.C. and Ranjan, R., *Renewable Energy Sources and Emerging Technologies*, 2nd ed., Delhi: Prentice Hall of India, 2016.
4.	Momoh, J., *Smart Grid: Fundamentals of Design and Analysis*, Wiley-IEEE Press, 2012.
5.	Sharma, P., and Rajput, S. (Eds.), *Sustainable Smart Cities in India: Challenges and Future Perspectives*, Springer Nature, 2017.
6.	McClellan, S., Jimenez, J.A., Koutitas, A. (Eds.), *Smart Cities: Applications, Technologies, Standards, and Driving Factors*, Springer Nature, 2018.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC421	**Semester** Odd **(specify Odd/Even)**	**Semester** 7th **Session** 2019 -2020 **Month from** July to December
Course Name	Image Analysis and Feature Extraction		
Credits	4	**Contact Hours**	3-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Abhishek Kashyap
	Teacher(s) (Alphabetically)	Dr. Abhishek Kashyap

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-1.1	Understanding the facts and ideas of Image Processing and demonstrate the review of Signal processing, Matrix algebra and Probability.	Understanding Level (C2)
C431-1.2	Develop the basic understanding of Sampling and Quantization of the processed Image and its Transforms.	Applying Level (C3)
C431-1.3	Examine the result in the processed image by applying Edge detection, Segmentation, Registration, Tracking and Reconstruction.	Analyzing Level (C4)
C431-1.4	Determine the object recognition, Image compression and its optimization using Nature inspired algorithm.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	What is Image Processing? Review of Signal processing, Matrix algebra, Probability/Statistics	7
2.	Image Processing	Sampling and Quantization, Image Transforms, Stochastic Models for Images, Image Enhancement, Image Filtering, Image Restoration	10
3.	Image Analysis/Computer Vision	Edge detection, Boundary Extraction, Segmentation, Level Set Method (brief introduction), Registration, Tracking, Reconstruction from Projections (Radon-transform, Fourier-transform, recent methods)	10
4.	Estimation topics	In the context of restoration, registration, segmentation, tracking, Bayesian cost functions, Least squares estimation, EM algorithm, alternating minimization, Monte Carlo methods, Kalman filter	10
5.	Nature inspired algorithm	Object Recognition, Image compression and optimization using Nature inspired algorithm	8

Total number of Lectures	**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance: 5 Marks, Assignment: 15 Marks, Quiz: 5 Marks)
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.	Milan Sonka et al: Image Processing, Analysis and Computer Vision
2.	Gonzalez and Woods: Digital Image Processing
3.	Rafael C.G. and Woods R.E.(1992) Digital Image Processing.

Course Code	19B12EC413	**Semester Odd (specify Odd/Even)**	**Semester 7 Session** 2019 -2020 **Month from** July **to** December
Course Name	Convergence and Next Generation Networks		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Prakash Chandra Gupta
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-3.1	Understand principles of multimedia, quality of service, network security and various signaling systems and their application session management..	Applying Level (C3)
C430-3.2	Apply and analyze above concepts for developing the framework required for secure transport of multimedia with required quality of service.	Analyzing Level (C4)
C430-3.3	Evaluate NGN architecture with application of QOS, security and signaling systems, and the current technology trends of network convergence.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Convergence and NGN	Introduction to convergence in telecommunications, and evolution of new generation networks (NGN).	1
2.	Voice/Multimedia over IP Network	(a) Audio/video digitization and compression, standard codecs. (b) RTP, RTCP, RTSP, streaming stored/live audio/video (c) QoS, RSVP, Differentiated service, Policy based QoS (d) PIM/IGMP protocols for multicasting	10
3.	Network Security	(a) Security basics (b) Security at IP layer, IPSec (c) Security at TCP layer, TLS	7
4.	Signaling Protocols for Converged Networks	(d) Session Initiation Protocol (SIP) (a) ITU-T H.323 (b) SS7 Signaling protocol and its transport over IP. (c) Interworking between networks based on SIP and SS7, SIP and H.323, H.323 and SS7	9
5.	Media Gateway Control & Softswitch	Separation of media and call control functions, softswitch architecture, media gateway control, MEGACO/H.248	2
6.	Next Generation Network	(a) NGN architecture (ITU-T Y.2012) (b) IP Multimedia subsystem (IMS) functional architecture (c) IMS addressing (d) Discovery and session control (e) IMS services, emergency services	9
7.	Fixed Mobile Convergence (FMC) & Unified Communications	(a) Overview of FMC, unified communications (b) Enabling technologies for FMC (GAN, Femtocell)	2
		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: (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	Hu Hanrahan, *Network Convergence*, John Wiley &Sons, 2007
2.	Lingfen Sun , Is-HakaMkwawa, Emmanuel Jammeh, Emmanuel Ifeachor, *Guide to Voice and Video over IP For Fixed and Mobile Networks*, Springer, 2013
3.	Daniels Collins, *Carrier Grade Voice Over IP*, MaGraw-Hill, 2003
4.	Prakash C Gupta, *Data Communications & Computer Networks*, PHI, 2006
5.	A. Ahson Syed, Ilyas Mohammad, *Fixed Mobile Convergence Handbook*, CRC Press.
6.	Prakash C Gupta, *Cryptography and Network Security*, PHI, 2014

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B12EC416	**Semester** odd	**Semester** 7th **Session** 2019 -2020 **Month from** June19 to Dec19
Course Name	Deep Learning for Multimedia		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. Abhinav Gupta
	Teacher(s) (Alphabetically)	Dr. Abhinav Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-7.1	Compare various loss functions and optimization methods for deep learning approaches	Understanding [C2]
C431-7.2	Experiment with various CNN architectures for related applications	Apply [C3]
C431-7.3	Apply and analyze sequence models for natural language processing	Analyzing [C4]
C431-7.4	Utilize and compare various deep learning techniques in real life problems	Evaluating [C5]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Neural Networks, Loss Functions and Optimization	Neuron Model and Network Architectures: Perceptron and Hamming networks. Perceptron learning rule and proof of convergence. Performance surfaces and optimum points: Performance Optimization, Steepest Descent, Stable Learning Rates and Widrow-Hoff Learning.	13
2.	Backpropagation and Generalization	Backpropagation: Multilayer Perceptrons, Function Approximation, Performance Index, Chain Rule, Backpropagating the Sensitivities, Convergence, Generalization., Methods for Improving Generalization: Early Stopping, Regularization, Relationship Between Early Stopping and Regularization	8
3.	Convolutional Neural Network (CNN) Architectures	Review: Feed forward neural net, Layers for Conv Nets, Feature Maps and Pooling, FC layer to Conv layer conversion, CNN to Classify Text and Images: LeNet5, AlexNet, VGG, ResNet.	10
4.	Sequential Networks	Recurrent Neural Networks, Adding Feedback Loops and Unfolding a Neural Network, Long Short-Term Memory, Recurrent Neural Network for word predictions, Autoencoders, Different Autoencoder Architectures, Neural Language Models: Word Embeddings and Word Analogies,	10

		Word2vec.	
		Total number of Lectures	41

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [Assignments and 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.	Introduction to Deep Learning, S. Kansi, Springer 2018
2.	Pattern Recognition and Machine Learning, C.M. Bishop, 2nd Edition, Springer, 2011.
3.	Deep Learning, I. Goodfellow, Y, Bengio, A. Courville, MIT Press, 2016.
4.	The Elements of Statistical Learning , T. Hastie, R. Tibshirani, J. Friedman., 2nd Edition, 2008
5.	Machine Learning Yearning , A. Ng, 2018

Detailed Syllabus

Lecture-wise Breakup

Subject Code	19B12EC417	**Semester: Odd (specify: Odd/Even)**	**Semester** 7th **Session** 2019-2020 **Month from** July to December
Subject Name	**Machine Learning and Statistical Pattern Recognition**		
Credits	4	**Contact Hours**	3-0-2
Faculty (Names)	**Coordinator(s)**	B. Suresh	
	Teacher(s) (Alphabetically)	B. Suresh	

S.NO	DESCRIPTION	COGNITIVE LEVEL
C430-6.1	Identify supervised learning generative/discriminative learning, parametric/non-parametric learning,	Applying Level (C3)
C430-6.2	Test for their Knowledge in Clustering, dimensionality reduction, kernel methods.	Analyzing Level (C4)
C430-6.3	Explain Bias/variance tradeoffs; VC theory; large margins	Understanding Level (C2)
C430-6.4	Utilize software Python to design and implement text and web data processing applications.	Applying Level (C3)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1	Basic Familiarity	Familiarity with the basic probability theory, Familiarity with the basic linear algebra	6
2.	supervised learning	Generative/discriminative learning, parametric/non-parametric learning, neural networks, support vector machines	10
3.	unsupervised learning	clustering, dimensionality reduction, kernel methods	9
4.	learning theory	bias/variance tradeoffs; VC theory; large margins	9

5.	Recent applications of machine learning	Robotic control, data mining, autonomous navigation, bioinformatics, speech recognition, and text and web data processing	8
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance: 5 Marks, Assignment: 15 Marks, Quiz: 5 Marks)
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.	Machine Learning A Probabilistic Perspective, Kevin P. Murphy.2012 MIT press.
2.	Computer Vision: Algorithms and Applications Richard Szeliski, 2019 Springer.
3.	The Elements of Statistical Learning Data Mining, Inference, and Prediction, Trevor Hastie, Robert Tibshirani Jerome Friedman.Second Edition 2017,Springer

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Lecture-wise Breakup

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

COURSE OUTCOMES : After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C401-7.1	explain field, vectors, vector spaces and their dimensions.	Understanding level (C2)
C401-7.2	apply linear transformations in solving practical engineering problems.	Applying Level (C3)
C401-7.3	develop the concept of rank, determinant, existence and uniqueness of solution of a system of linear equations.	Applying Level (C3)
C401-7.4	explain the concept of length, distance and inner-product.	Understanding level (C2)
C401-7.5	apply the concept of orthogonality and orthogonal matrices to orthogonalize a set of linearly independent vectors.	Applying Level (C3)
C401-7.6	analyze eigenvalues, eigenvectors and their properties to solve a system of ordinary differential equations.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Vector Space and Dimension	Field, Vector Space, Vector subspace, linear dependence and independence, Span of a set, Dimension of a vector space, Direct Sum and Complement	7
2.	Linear Transformation I	Linear Transformation and its algebra, and its matrix representation, homomorphism, isomorphism, rank and null subspace, rank-nullity theorem, Solution of a system of Linear Equations, Determinant	7
3.	Linear Transformation II	Change of basis, Inverse of a linear transformation, Linear functional, transpose	5
4.	Inner Product and Metric	Inner product space, Metric and normed spaces. Orthonormal basis, Orthogonal Subspaces, Gram-Schmidt orthogonalization.	8
5.	Eigen Values and Eigen Vectors	Eigen values and Eigenvectors, Modal matrix and diagonalization, Similarity Transformation, Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices	9

6.	Applications of Linear Algebra	Bilinear and Quadratic forms, Positive definite matrices, Norm of a matrix, Condition number, Application to find solutions of ordinary differential equations	6
Total number of Lectures			**42**

Evaluation Criteria

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

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

1.	**Hoffman, K and Kunze, R.** , Linear Algebra, Fourth Edition, Prentice Hall of India, 2005
2.	**Strang, G**., Linear Algebra and its Applications, 3rd Ed., 1998
3.	**Noble, B. and Daniel, J.** , Applied Linear Algebra, Prentice Hall of India, 2000
4.	**Lipshutz, S. and Lipsom, M. ,** Linear Algebra, 3rd Edition, Schaum Series, 2001
5.	**Krishnamurthy, V., Mainra, V. P., and Arora, J. L.** , An Introduction to Linear Algebra, Affilated East-West, 1976

Detailed Syllabus
Lecture-wise Breakup

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

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

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

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

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Quiz , Assignments, Tutorials)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**Gerald, C.F. and Wheatley P.O.**, Applied Numerical Analysis, 6th Ed., Pearson Education, 1999.
2.	**Conte, S.D. and DeBoor, C.**, Elementary Numerical Analysis, 3rd Ed., McGraw-Hill, 1980.
3.	**Gupta, R.S.**, Elements of Numerical Analysis, 1st Ed., Macmillan 2009.
4.	**Jain, M.K., Iyengar, S.R.K. and Jain, R.K.**, Numerical Methods for Scientific and Engineering Computation 5th Ed., New Age International, New Delhi, 2007.
5.	**Smith, G.D.**, Numerical Solution of Partial Differential Equations, 2nd Ed., Oxford, 1978.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12MA412	**Semester** Odd	**Semester** VII **Session** 2019-2020 **Month from**July 2019 - Dec 2019
Course Name	Generalized Fuzzy Set Theory with Applications		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. AmitSrivastava
	Teacher(s) (Alphabetically)	Dr.AmitSrivastava Dr.Mohd. Sarfaraz

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 (*IFS*s) – Basic definitions and operations.Measures of entropy, similarity and discrimination between Intuitionistic fuzzy sets (*IFS*s).Applications of *IFS*s 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 (…)
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***, SpringerVerlag, 2014.
3.	Bhargava, A. K., ***Fuzzy Set Theory, Fuzzy Logic and Their Applications***, S. Chand & Company Pvt. Ltd., 2013.
4.	CengizKahraman, UzayKaymak, 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, ZeshuiXu, ***Hesitant Fuzzy Decision Making Methodologies and Applications***, Uncertainty and Operations Research, Springer Verlag, 2017.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12MA411	**Semester** Odd		**Semester** VII **Session** 2019 -2020 **Month from** July 2019- Dec 2019	
Course Name	Elements of Statistical Learning				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. HimanshuAgarwal			
	Teacher(s) (Alphabetically)	Dr. HimanshuAgarwal			

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C401-22.1	explain different type of learning techniques.	Understaning Level (C2)
C401-22.2	apply and analyze linear regression techniques	Analyzing Level (C4)
C401-22.3	apply and analyze linear classification techniques	Analyzing Level (C4)
C401-22.4	use and analyse sparse kernel machines	Analyzing Level (C4)
C401-22.5	compare learning models.	Analyzing Level (C4)
C401-22.6	apply unsupervised learning techniques.	Applying Level (C3)

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

		Reduction, and Local Multidimensional Scaling, The Google Page Rank Algorithm	
Total number of Lectures			**42**

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

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

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

Detailed Syllabus

Lecture-wise Breakup

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	17B11EC732	**Semester** Odd **(specify Odd/Even)**	**Semester VII Session** 2019 -2020 **Month from** July to Dec.
Course Name	Cognitive Communication Systems		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Vivek Dwivedi Sajal Agarwal
	Teacher(s) (Alphabetically)	…

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-2.1	Understand the concepts of various generation of wireless communication and spectrum scarcity.	Understanding (Level II)
C431-2.2	Understand the concepts of radio (CR) architecture, functions of cognitive radio	Understanding (Level II)
C431-2.3	Analyzing the Spectrum sharing and management and Spectrum sensing methods	Analyzing (Level IV)
C431-2.4	Evaluating the performance of optimization of dynamic spectrum access and management	Evaluating (Level V)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction of various generation of wireless communication, Spectrum scarcity, cognitive radio (CR) architecture, functions of cognitive radio, Fundamental challenges and issues in designing cognitive radio	8
2.	Spectrum sharing and management	Spectrum access models,dynamic spectrum access (DSA), underlay, overlay and hybrid cognitive radio, Potential applications of cognitive radio	8
3.	Spectrum sensing	Interference temperature/channel estimation , Detection of spectrum holes, Practical spectrum sensing approaches, Collaborative sensing, External Sensing	12
4.	Techniques for optimization of dynamic spectrum access and management	Optimization techniques, Constrained optimization, Lagrangian method, Optimality, Primal-dual algorithm, Linear programming and the simplex algorithm, Non-linear programming , applications of cognitive radio	14
		Total number of Lectures	42

Evaluation Criteria

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

Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	E. Hossain, D. Niyato, and Z. Han, Dynamic Spectrum Access and Management in Cognitive Radio Networks, Cambridge University Press, 2009 (ISBN: 978-0-521-89847-8)
2.	Cognitive radio networks, Kwang-Cheng Chen, Ramjee Prasad, John Wiley & Sons Ltd
3.	Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Huseyin Arslan, Springer.
4.	Software Radio: A Modern Approach to Radio Engineering By Jeffrey H. Reed Pearson Education Low Price Edition

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC412	**Semester**Odd **(specify Odd/Even)**	**Semester** 7th **Session** 2019 -2020 **Month from** July to Dec
Course Name	Multimedia Communications		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Richa Gupta
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES Upon completion of the course, the students will be able to		**COGNITIVE LEVELS**
C430-7.1	familiarize with basics of data compression used in the development of various construction algorithms for source codes.	Applying [C3]
C430-7.2	identify theoretical and practical requirements for implementation and designing of Error Resilient Codes.	Applying [C3]
C430-7.3	learn fundamentals of transform coding, digital image processing and its applications.	Applying [C3]
C430-7.4	analyse the need of image compression & video compression and distinguish between different image CODECs.	Analysing [C4]
C430-7.5	familiarize with psychoacoustic principle used in the development of audio codec standards.	Analysing [C4]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Information Theory	Introduction, Information Measure, Discrete entropy. Joint and conditional entropies.	3
2.	Data Compression	Uniquely Decipherable Codes and Instantaneous Codes. Kraft - McMillan inequality. Noiseless coding Theorem. Data Compression: Lossless Compression and Lossy Compression. Optimal codes. Construction algorithms of source codes – Huffman Codes, Shannon - Fano codes, Arithmetic Codes, Lempel Ziv Welch Code and Run Length Coding.	8
3.	Error Resilient Codes	Reversible Variable Length Codes: Introduction, Types of RVLCs, Construction Algorithms of Symmetrical and Asymmetrical RVLCs. Applications of RVLCs in Multimedia Communications.	8
4.	Multimedia Information Representation and Transform Coding	Introduction, Digital Principles, Representations of text, image, audio and video data. Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.	3

5.	Digital Image Processing	Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components. Image Enhancement, Image segmentation, Image Restoration and Morphological Image Processing.	12
6.	Image Compression	Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression.	3
7.	Video Compression	Basic principle of video processing, I, P and B pictures in video content, Structure of video frame, Macroblock, Motion Estimation and Compensation, Compression on the block level, Video Coding Standards.	4
8.	Audio Compression	Basics of Audio Signal Processing, Principle of Psychoacoustic and its applications, Audio Compression and Standards for Audio codec.	4
		Total number of Lectures	**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Research Assignment, Assignment, Quiz, Class Tests)
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.	M. Bosi and R. Goldberg, Introduction to Digital Audio Coding and Standards. Kluwer Academic, Boston, 2003.
2.	R. C. Gonzalez and R. E. Woods, Digital Image Processing Using MATLAB, Prentice Hall, 2009.
3.	K. Sayood, Introduction to data compression, Elsevier, 4th edition.
4.	A. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989.