Advanced Operations Research (18M12MA111)

Course Description

Course Code	18M12MA111	Semester Odd		Semester IIISession 2021-22 Month fromAug - Dec 2021	
Course Name	Advanced Operations Research				
Credits	3		Contact Hours	3-0-0	
Faculty (Names)	Coordinator(s)	Prof. A. K. Aggarwal			
	Teacher(s) (Alphabetically)	Prof. A.K. Aggarwal			

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C203.1	construct and solve linear programming problems and analyze their optimal solution using parametric and sensitivity analysis	Analyzing Level (C4)
C203.2	identify and solve the inventory models with and without shortages.	Applying Level (C3)
C203.3	construct the network diagram and analyze the critical activities using PERT/CPM for project planning.	Analyzing Level (C4)
C203.4	identify pure and mixed strategy games and solve and analyze them using graphical and linear programming techniques.	Analyzing Level (C4)
C203.5	solve multi-objective programming problems by graphical and simplex method.	Analyzing Level (C4)
C203.6	demonstrate Kuhn-Tucker conditions and apply them to solve non-linear programming problems, quadratic and separable programming problems.	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review of Linear Programming Problems and Duality	Convex sets, graphical and simplex method, artificial variable techniques, revised simplex method, duality theory, dual simplex method, revised dual simplex method.	5
2.	Parametric and Sensitivity Analysis	Sensitivity analysis, parametric linear programming, parametric sensitivity analysis.	5
3.	Inventory	Introduction, inventory models, economic order quantity (EOQ), deterministic and probabilistic inventory models, inventory control.	7
4.	Network Analysis	Network diagram, project planning using critical path method (CPM) and program evaluation review technique (PERT), crashing of network, simulation techniques.	7
5.	Games and Strategies	Pure and mixed strategies, minimax (maximin) criterion of optimality, solution of various models in game theory by graphical and linear	6

		programming technique, rules of dominance.	
6.	**Multi-objective Programming Problems**	Solution of multi-objective programming problems by graphical and simplex method.	**4**
7.	**Nonlinear Programming Problems**	Convex functions and their properties, Kuhn Tucker theory, convex quadratic programming, Wolfe's and Beale's algorithm, Separable convex programming.	**8**
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Students will be divided in a group of 4-5 to conduct literature survey, case study on inventory models, project planning, multi-objective linear programming and nonlinear programming problems in real life. The students will solve the problems with the help of MATLAB and submit a detailed report and present their important outcomes also.

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.	**Taha,H. A.**, Operations Research – An Introduction, Tenth Edition, Pearson Education, 2017.
2.	**Rao,S. S.**, Engineering Optimization, Theory and Practice, Fourth Edition, John Wiley, 2009.
3.	**Deb**, K., Optimization for Engineering Design, Algorithms and Principles, PHI, 2010.

Course Code	20M32EC113	Semester …Even Semester (specify Odd/Even)	Semester 2nd, Session 2021 -2022 Month from Feb to May 22
Course Name	Bio Medical Signal Processing		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Mrs.Smriti Bhatnagar
	Teacher(s) (Alphabetically)	Mrs.Smriti Bhatnagar.

COURSE OUTCOMES		COGNITIVE LEVELS
C124.1	Recall the Concept of Digital Signal Processing.	C1
C124.2	Introduction of Bio Medical Systems and need and importance of Bio Medical Signal Processing.	C2
C124.3	Generation and acquisition of Bio Medical Signals for different Bio Medical Systems.	C3
C124.4	Applying different Signal Processing Techniques and tools for removing artefacts from acquired Bio Signals and identifying different diseases from data..	C4

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Revision of Fundamentals of Signal Processing and Filter Design	Sampling and aliasing, Signal reconstruction, Signal conversion systems, Circular convolution Correlation-Autocorrelation – Cross correlation, FFT-decimation in time algorithm, Decimation in Frequency algorithm Basics of filter, Design of IR filter-impulse invariant method – Bilinear Transformation Method Warping and pre-warping effect, Frequency transformation, Characteristics of FIR filter and design of FIR filter .	6L
2.	Introduction Different Biomedical Signals and systems.	The Nature and Examples of Biomedical Signals The electrocardiogram (ECG), The electroencephalogram (EEG),The phono cardiograrn(PCG) Basic electrocardiography: ECG lead systems :ECG signal characteristics	12L

3.	Wavelets and and its use as a tool in Bio Signal Processing:	Introduction to wavelets, Time frequency representation, Discrete wavelet transform, pyramid algorithm, Comparison of Fourier transform and wavelet transform, Speech analysis – Cepstrum – Homomorphic filtering of speech signals, ECG signal characteristics – EEG analysis	10L
4.	Analysis of Bio-signals	Automatic analysis and classification of ECG, P-wave detection, QRS complex detection, Correlation analysis of ECG signals, Signal averaged ECG, Analysis of Heart Rate variability, Synchronized averaging of PCG envelopes, Analysis of PCG signal, Analysis of EMG signal	12L
		Total number of Lectures	**40 L**

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.	C.Reddy "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005.
2.	Biomedical signal analysis-A Case-Study Approach, Rangaraj M Rangayan (Wiley-Interscience, John Wiley & Sons, Inc)
3.	
4.	.Digital Signal Processing, Principles Algorithms and Applications, Third edition; John G, Proakis and Dimitris G Manolakis (Prentice Hall)

Detailed Syllabus
Lecture-wise Breakup

Course Code	19M13HS211	Semester: Odd	Semester: M.Tech III and M.Tech Integrated X Session: 2021 -2022 Month from: August-December 2021
Course Name	**Constitution of India**		
Credits	2	Contact Hours	2-0-0

Faculty (Names)	Coordinator(s)	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri Ms. Puneet Pannu

COURSE OUTCOMES		COGNITIVE LEVELS
C202.1	Demonstrate an understanding of the historical inheritances and institutional legacies of Indian Constitution	Understand (C2)
C202.2	Assess the nature of the Indian constitution and its applicability in the study of politics in India.	Evaluate (C5)
C202.3	Assess the devolution of powers and authority of governance of the Union government and the local government	Evaluate (C5)
C202.4	Demonstrate an understanding of the powers and functions of the Indian executive, legislature and judiciary	Understand (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	History of Making of the Indian Constitution	• History • Drafting Committee-Composition & Working	2

2.	Philosophy of the India Constitution	• Preamble • Salient Features • Federalism	2
3.	Fundamental Rights and Directive Principles	• Right to Equality • Right to Freedom • Right against Exploitation • Right to Freedom of Religion • Cultural and Educational Rights • Right to Constitutional Remedies • Directive Principles of State Policy • Conflict between DPSP and FR • Fundamental Duties	5
4.	Organs of Governance	• Parliament-Composition, Qualifications & and Disqualification, Powers and Functions • Executive- President, Governor Council of Ministers • Judiciary-Appointment and Transfer of Judges, Qualifications, Power and Functions	8
5.	Local Administration	• District's Administration head: Role and Importance • Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation • Panchayati raj: Introduction, PRI: Zila Panchayat. • Elected officials and their roles, CEO Zila Panchayat: Position and role • Block level: Organizational Hierarchy (Different departments) • Village level: Role of Elected and Appointed officials • Importance of Grass root democracy	8
6.	Election Commission	• Election Commission: Role and Functioning	3
Total number of Lectures			**28**

Evaluation Criteria	
Components	Maximum Marks
Mid Term:	30
End Semester Examination	40
TA	30 (Attendance,Quiz, Project)
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.	Austin, G. (1996). *The Indian Constitution: Corner Stone of a Nation*. Oxford: Oxford University Press
2.	Bakshi, P.M.(2015). *The Constitution of India*. Delhi: Universal Law Pub. Co. Pvt. Ltd
3.	Bhuyan, D. (2016). *Constitutional Government and Democracy in India*. Cuttack:Kitab Mahal..
4.	Busi, S.N. (2016). *Dr. B. R. Ambedkar framing of Indian Constitution*. Hyderabad:Ava Publishers
5.	Basu, D.D. (2018). *Introduction to the Constitution of India*. Nagpur: Lexis Nexis
6.	Jayal, N.G. & Mehta, P.B. (eds.)(2010). *The Oxford Companion to Politics in India*. New Delhi: Oxford University Press.
7.	Constitution series by Rajya Sabha Television and discussion on Indian Constitution by Rajya Sabha Television

Course Code	**19M12HS211**	Semester: Odd (specify Odd/Even)	Semester: III Session: 2021 -2022 Month from: July-December
Course Name	**Cost Accounting for Engineering Projects**		
Credits	03	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Praveen Kumar Sharma
	Teacher(s) (Alphabetically)	Dr. Praveen Kumar Sharma

COURSE OUTCOMES		COGNITIVE LEVELS
C201.1	Understand basic concepts of Cost Accounting	Understand (C2)
C201.2	Apply concepts of cost in project management	Apply (C3)
C201.3	Analyze cost behaviour for decision making	Analyze (C4)
C201.4	Construct different budgets for controlling the cost	Create (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction & Overview of Strategic Cost Management Process	2
2.	Cost Concepts	Relevant Cost, Differential Cost, Incremental Cost, Opportunity Cost, Objectives of a costing system, Inventory Valuation, Provision of data for decision making	4
3.	Project execution	Meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities.	5
4.	Project Execution & Quantitative	Pre project execution main clearances and documents Project team: Role of each member. Importance Project site	7

		techniques for cost management	Data required with significance, Project contracts, Types and contents, Project execution, Project cost control, bar charts, Project commissioning, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory	
5.		Cost Behavior	Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.	6
6.		Profit Planning Marginal Costing	Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach,	6
7.		Material Planning	Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card& value chain analysis.	6
8.		Budgetary Control	Flexible budgets, Performance budgets, zero based budgets, Measurements of divisional profitability pricing decisions including transfer pricing.	6
Total number of Lectures				**42**

Evaluation Criteria

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

Project based learning: student will form the group of four to five students. To make subject application based, student will apply various concepts such as Cost management and various types of Costing, project execution & quantitative technique for cost management, cost behaviour and profit planning. Student will apply these concept on organization, or in any ongoing project or interdisciplinary base research project or any innovative idea in any particular industry along with feasibility.

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. S. M. Datar and M. Rajan, *Horngren's Cost Accounting: A Managerial Emphasis. 16th ed*. Pearson Education, 2018.

2.	B. M. L. Nigam and I. C. Jain, *Cost Accounting: Principles And Practice*, PHI Learning Pvt. Ltd. PHI Learning Pvt. Ltd., 2010.
3.	R. S. Kaplan and A. A. Atkinson, *Advanced management accounting*. PHI Learning, 2015.
4.	A. K. Bhattacharyya, *Principles and practice of cost accounting*. PHI Learning Pvt. Ltd., 2004.
5.	N. D. Vohra, *Quantitative Techniques in Management, 3e*. Tata McGraw-Hill Education, 2006.
6.	C. Drury, *Management and Cost Accounting ,10th edition, Cengage Learning*. 2017.
7.	P. Chandra, *Projects-Planning Analysis, Selection, Implementation & Review 9e, Tata McGraw Hill, New Delhi.* 2019.

Course Code	20M31EC114		**Semester:** ODD 2021 **(specify Odd/Even)**	**Semester:** 1st **Session:** 2021-22 **Month from:** Aug 2021 to Dec 2021
Course Name	Digital Image and Video Processing			
Credits	3		**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**		Richa Gupta	
	Teacher(s) (Alphabetically)		Richa Gupta	

COURSE OUTCOMES- At the completion of the course, students will be able to		COGNITIVE LEVELS
C115.1	familiarize with the concept of digital image formation, image structure and transform coding.	Applying Level (C3)
C115.2	understand the basics of digital image processing with necessary skills to solve practical problems.	Applying Level (C3)
C115.3	Learn fundamentals of digital video processing, motion estimation and compensation.	Applying Level (C3)
C115.4	Identify the need of image & video compression, and image & video applications.	Applying Level (C3)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Fundamentals of Digital Image and Image Transform	Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components, Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.	6
2.	Digital Image Processing	Image Enhancement - Spatial Domain Processing: Digital Negative, Contrast Stretching, Thresholding, Gray Level Slicing, Bit Plane Slicing, Log Transform and Power Law Transform. Neighborhood Processing: Averaging filters, Order statistics filters, High pass filters and High boost filters, Filtering in frequency domain: Smoothing and Sharpening filters, Image Segmentation, Image Restoration & Construction, Morphological Image Processing, Image quality assessments.	10

3.	Digital Video Processing	Digital Video Sampling and Interpolation, Video Frame Classifications, I, P and B frames, Notation, Motion Estimation and compensation, Application of motion estimation in video coding, Video Enhancement and Restoration, Video quality Assessment.	9
4.	Image Compression and Video Compression	Data Compression: Lossless Compression and Lossy Compression, Optimal codes, Construction algorithms of source codes - Huffman Codes, Error Resilient Codes–types, construction and applications, Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression, Basics of Video Compression, Inter-frame and Intra-frame redundancy, Video Coding Standard – H.263++	10
5.	Image and Video Applications	Image and Video Segmentation, Biomedical Image Processing, Image Annotation, Video Annotation, Video surveillance.	8
		Total number of Lectures	**43**

Evaluation Criteria

Components	Maximum Marks	
T1	20	
T2	20	
End Semester Examination	35	
TA	25	(Attendance, Performance. Assignment/Quiz)
Total	**100**	

Project Based Learning: Students are required to prepare a consolidated summary (including approach, limitations, pros and cons, applications, scope etc.) of any recent research paper published in reputed International Conference or International Journal related to Image and Video processing. They will submit this research assignment towards the end of the semester.

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.	Gonzaleze and Woods, "Digital Image Processing using MATLAB", 2nd Edition, McGraw Hill Education, 2010.
2.	K. Sayood, Introduction to data compression, Elsevier, 5th edition, 2017
3.	A Murat Tekalp, "Digital Video Processing", Prentice Hall, 2nd Edition, 2015

Subject Code	19M13HS111		Semester: Even	Semester: M.Tech II & Dual degree VIII Session 2021-22
				Month from February to June 2022
Subject Name	**English Language Skills for Research Paper Writing**			
Credits	**2**		**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**		Ms. Rashmi Jacob	
	Teacher(s) (Alphabetically)		Ms. Rashmi Jacob	

Course Outcomes:

At the completion of the course, students will be able to,

COURSE OUTCOMES		COGNITIVE LEVELS
C204.1	Demonstrate an understanding of all the aspects of grammar and language needed to write a paper.	Understand Level (C2)
C204.2	Apply grammatical knowledge & concepts in writing and presentation.	Apply level (C3)
C204.3	Examine each section of a paper after careful analysis of Literature Review.	Analyze Level (C4)
C204.4	Determine the skills needed to write a title, abstract and introduction, methods, discussion, results and conclusion.	Evaluate Level (C5)
C204.5	Compile all the information into a refined research paper after editing and proofreading	Create Level (C6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lecturesand Tutorials for the module
1.	Grammar & Usage	Structure of English Language Voice, Aspect & Tense SVOCA Sense & Sense Relations in English Enhancing Vocabulary Connotation, Denotation & Collocation	**6**
2.	Elements of Paper Writing	Planning & Preparation Word Order Breaking Long Sentences Structuring Paragraphs Being Concise and RemovingRedundancy Avoiding Ambiguity and Vagueness	**4**
3.	Paraphrasing & Writing	Highlighting Your Findings Hedging andCriticising Paraphrasing and Plagiarism Sections of a Paper Abstracts; Introduction	**6**

4.	Process of Writing	Review of Literature Methods Results Discussion Conclusion The Final Check	4
5.	Key Skills Needed	Key skills needed when writing a Title Key skills needed whenWriting an Abstract Key skills needed when writing an Introduction Key skills needed when writing a Review of the Literature Key skills needed when writing Methods & Results Key skills needed when writing Discussion & Conclusion	4
6.	Refining the Paper	Incorporating useful phrases Editing Proofreading References Annexures Ensuring good quality in submission	4
		Total number of Lectures and Tutorials	**28**

Evaluation Criteria

Components	MaximumMarks
Mid Term	30
End Semester Examination	40
TA	30 (Project, Assignment/ Class Test/ Quiz, Class Participation)
Total	**100**

3. Employability/entrepreneurship/skill development

Researchers whose first language is not English write at least two-thirds of published scientific papers. Twenty percent of the comments referees make when reviewing papers for possible publication in international journals regard English language issues. In some disciplines, acceptance rate by journals of papers originating from the US/UK is 30.4%, and is higher than all other countries

Publishing your research in an international journal is key to your success in academia. This course is based on a study of some sample manuscripts and reviewers' reports revealing why papers written by non-native researchers are often rejected due to problems with English usage and poor structure and content. The course prepares the students on how to:

- prepare and structure a manuscript
- increase readability and reduce the number of mistakes you make in English by writing concisely, with no redundancy and no ambiguity
- write a title and an abstract that will attract attention and be read
- decide what to include in the various parts of the paper (Introduction, Methodology, Discussion etc)
- highlight your claims and contribution
- avoid plagiarism
- discuss the limitations of your research
- choose the correct tenses and style
- satisfy the requirements of editors and reviewers

	Recommended Reading material:
1.	Goldbort R. 'Writing for Science', Yale University Press (available on Google Books), 2006
2.	Day R. 'How to Write and Publish a Scientific Paper', Cambridge University Press, 2006
3.	Adrian Wallwork. 'English for Writing Research Papers', Springer, New York, Dordrecht Heidelberg, London, 2011
4.	Yadugari M.A. ' Making Sense of English: A Textbook of Sounds, Words & Grammar' Viva Books Private Limited, New Delhi, 2013, Revised Edition
5.	Strauss Jane. 'The Blue Book of Grammar and Punctuation, Josseybass, Wiley, San Francisco, 1999.
6.	Rizvi, A. R. 'Effective Technical Communication' 2nd edition, McGraw Hill Education Private Limited, Chennai, 2018
7.	Eckert, K. 'Writing Academic Paper in English:Graduate and Postgraduate Level', Moldy Rutabaga Books, 2017
8	Barros, L.O, 'The Only Academic Phrasebook You'll Ever Need: 600 Examples of Academic Language' Create Space Independent Publishing Platform; 1st edition,2016
9	Wallwork, A. 'English for Writing Research Papers (English for Academic Research)'.Springer; 2nd ed. 2016 edition.
10	Wallace,M&Wray,A. 'Critical Reading and Writing for Postgraduates (Student Success) SAGE Publications Ltd; Third edition, 2016
11	Butler, L. 'Longman Academic Writing Series 1: Sentences to Paragraphs, with Essential Online Resources', Pearson Education ESL; 2nd edition,2016
12	Saramäki, J. 'How to Write a Scientific Paper: An Academic Self-Help Guide for PhD StudentsIndependently published, 2018

Lecture-wise Breakup

Course Code	20M31EC116	Semester: Even (specify Odd/Even)	Semester 2ⁿᵈ Session 2021-22
			Month from Jan 2022 to May 2022
Course Name	Hybrid Intelligent System		
Credits	4	Contact Hours	3-1-0
Faculty (Names)	Coordinator(s)	Dr. Ruby Beniwal	
	Teacher(s) (Alphabetically)	Dr. Ruby Beniwal	

COURSE OUTCOMES- At the completion of the course, students will be able to		COGNITIVE LEVELS
CO1	Identify and describe hybrid techniques and their roles in building intelligent system	Understanding Level (C2)
CO2	Apply Neuro- fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	Applying Level (C3)
CO3	Effectively use modern software tools to solve real problems using a hybrid approach and evaluate various hybrid computing approaches for a given problem	Evaluating Level(C 5)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction of neural network	Introduction to neural network Single layer and Multilayer neural network and Associative Memory network,Feedback netwok,Support Vector Machine and its application	7
2.	Introduction of fuzzy logic and Genetic algorithm	Introduction fuzzy set theory ,membership function and operation fuzzy system .fundamental of genetic algorithms and modeling	7
3.	Hybrid system	Introduction of hybrid system, Sequential, Auxiliary and Embedded hybrid system	2
4.	Neuro Fuzzy Modelling:	Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS	10

		and RBFN, Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum. Introduction to Neuro Fuzzy Control.	
5.	Fuzzy Back propagation Network	LR type Fuzzy numbers and operations on it,fuzzy neuron ,fuzzy BP architecture, learning in fuzzy BP and interference by fuzzy BP and its application	5
6.	Genetic Algorithm based back propagation network	GA based weight determination ,coding, weight extraction fitness function ,reproduction and convergences and its application	7
7.	Simplified Fuzzy ARTMAP and Associative Memories	Fuzzy ARTMAP and its working ,introduction of FAM and Fuzzy Hebb FAM	7
		Total number of Lectures	**45**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
Total	**100**

Project Based Learning : Students will learn different type algorithms based on Neuro- Fuzzy logic and Neuro-Genetic algorithm through Assignments in the area of Hybrid Intelligent System. Additionally, students in group sizes of two-three required to implement any one application of Hybrid Intelligent System one or more research publications.

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.	*Larry R. Medsker, Hybrid Intelligent Systems 1995th*
2.	Simon Hykins, Neural Networks And Learning Machines, Pearson Publishing House, 2016
3.	S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India, 2018
4.	Clinton Sheppard, Genetic Algorithms with Python CreateSpace Independent Publishing Platform ,April 29, 2016
5.	S. Rajasekaran and G. A. vijayalakshmi Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications ,PHI-2013

Detailed Syllabus

Lecture-wise Breakup

Course Code	19M12EC112	Semester Odd semester (specify Odd/Even)	Semester 1ST Session 2021-22 Month from August 2021 to Dec 2021.
Course Name	Soft computing		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Vijay Khare
	Teacher(s) (Alphabetically)	Dr. Vijay Khare

COURSE OUTCOMES		COGNITIVE LEVELS
C120. 1	Explain soft computing techniques and their roles in building intelligent machines	Understanding Level (C2)
C120.2	Apply neural networks to pattern classification and regression problems	Applying Level (C3)
C120.3	Apply fuzzy logic and genetic algorithms to handle uncertainty and optimization problems	Applying Level (C3)
C120.4	Evaluate and compare solutions by various soft computing approaches for a real time problem use existing software tools.	Evaluating Level (C 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction of soft computing .evolution of computing, hard computing and soft computing, soft computing methods.	2
2.	Fundamental of neural network	Introduction of neural network , Neuron models and n/w architecture Learning in Artificial Neural Networks; Supervised, Unsupervised and Competitive Learning paradigms, perceptron neural network: Adaline and Madaline	7
3.	Feed forward neural network and applications	Multi layer Feed forward neural network, back propagation algorithms and radial basis neural network, Application of neural network	8
4.	Associated Memory	Auto associative memory, Hetro associated memory bidirectional associated memory	5
5.	Unsupervised learning	LVQ(Learning Vector Quantization) Self organization map, Adaptive resonance theory	6
6.	Fuzzy logic	Introduction, classical and Fuzzy sets &operations	9

		crisprelation and fuzzy relation Fuzzy rules based system, Fuzzy Controller Design	
7.	Genetic Algorithms	Introduction of Genetic Algorithms, Genetic Operators, Crossover and mutation properties, Genetic Algorithms in Problem Solving,	8
		Total number of Lectures	**45**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Assignment, 5 Quiz, 5 Class Participation, 10 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	Jacek M. Zurada, *Introduction to Artificial Neural Systems,Jaico Publishing House, 1994*
2	Martin T. Hagan, Howard B. Demuth, Mark Beale, *Neural Network Design-Martin Hagan,2014*
3	SimonHykins, Neural Networks And Learning Machines, Pearson Publishing House, 2016
4	S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India, 2018
5	Clinton Sheppard, Genetic Algorithms with Python CreateSpace Independent Publishing Platform (April 29, 2016
6	Rajasekharan and Rai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications ,PHI-2013

Detailed Syllabus

Lecture-wise Breakup

Subject Code	20M32EC114	Semester Odd	Semester 1st Session 2021-22
			Month from Sept 2021 to Jan 2022
Subject Name	Speech and Audio Signal Processing (Elective M.Tech MLSP)		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Kuldeep Baderia,
	Teacher(s) (Alphabetically)	Kuldeep Baderia

COURSE OUTCOMES		COGNITIVE LEVELS
C125.1	Identify various classicification of speech signals and their corresponding phonetics	Applying Level (C3)
C125.2	Test for their Knowledge in understanding time domain techniques and frequency domain techniques etc.	Analyzing Level (C4)
C125.3	Explain Homomorphic signal processing and Linear predictive analysis of speech signals	Understanding Level (C2)
C125.4	Analysis of Digital Encoding of speech signal.	Analyzing Level (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	**Fundamentals of Human Speech Production**	Introduction, The Process of Speech Production, Short-Time Fourier Representation of Speech, Acoustic Phonetics , Distinctive Features of the Phonemes of American English	5
2.	**Time-Domain Methods for Speech Processing**	Short-Time Analysis of Speech, Short-Time Energy and Short-Time Magnitude, Short-Time Zero-Crossing Rate, The Short-Time Autocorrelation Function ,The Modified Short-Time Autocorrelation Function, The Short-Time Average Magnitude Difference Function	8

3.	**Frequency-Domain Representations**	Discrete-Time Fourier Analysis,Short-Time Fourier Analysis , Spectrographic Displays, Overlap Addition Method of Synthesis, Filter Bank Summation Method of Synthesis, Time-Decimated Filter Banks, Two-Channel Filter Banks, Implementation of the FBS, Method Using the FFT, OLA Revisited ,Modifications of the STFT.	8
4.	**The Cepstrum and Homomorphic Speech Processing**	Homomorphic Systems for Convolution, Homomorphic Analysis of the Speech Model , Computing the Short-Time, Cepstrum and Complex Cepstrum of Speech, Homomorphic Filtering of Natural Speech, Cepstrum Analysis of All-Pole Models Cepstrum Distance Measures	8
5.	**LINEAR PREDICTIVE ANALYSIS OF SPEECH**	Computation of the Gain for the Model ,Frequency Domain Interpretations of Linear Predictive Analysis, Solution of the LPC Equations The Prediction Error Signal	8
6	**Digital Coding of Speech Signals**	Sampling Speech Signals, A Statistical Model for Speech, Instantaneous Quantization Adaptive Quantization Quantizing of Speech, Model Parameters, General Theory of Differential Quantization, Delta Modulation ,Differential PCM (DPCM), Enhancements for ADPCM Coders ,Analysis-by-Synthesis Speech Coders, Open-Loop Speech Coders	5
		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**

Project based Learning Component: Speech and Audio signal processing is very important part of every communication system. In this course various project based learning components have been included like STFT, Cepstrum and Homomorphic Speech Processing, analysis and recognition of speech and audio system etc. During this subject students will learn various practical aspects of speech and audio digital signal processing.

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.	L. Rabiner, R. Schafer, Theory and Applications of Digital Speech Processing, Pearson, 2011
2.	J. R. Deller, J. H. L. Hansen, J. G. Proakis. Discrete-Time Processing of Speech Signals. IEEE Press, 2000
3.	Daniel Jurafsky, James H. Martin, Speech and Language Processing, 2nd Edition, Pearson, 2009
4.	Dr. Shaila D. Apte, Speech and Audio processing.Wiley-India, 2019.
5.	Ben Gold and Nelson Morgan, Speech and Audio Signal Processing- Processing and Perception of Speech and Music. Wiley-India, 2006.