Detailed Syllabus

Lecture-wise Breakup

Course Code	20M31EC113	**Semester** :Odd 2020**(specify Odd/Even)**	**Semester** Ist **Session** 2020 -2021 **Month from July 2020 –Dec 2020**
Course Name	Introduction to Machine Learning		
Credits	3	**Contact Hours**	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Illustrate various machine learning approaches	Understanding (C2)
CO2	Experiment with the different techniques for feature extraction and feature selection	Applying (C3)
CO3	Apply and analyze various classifier models for typical machine learning applications	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction and Basic Concepts	Linear algebra, Probability distributions, Types of Data, Linear Models for Regression, Feature Extraction and Feature Selection.	10
2.	Introduction to Neural Networks	Neuron Model and Network Architectures: Perceptron and Hamming networks. Perceptron learning rule, Steepest Descent, Stable Learning Rates. Multilayer Perceptrons: Generalization, Methods for Improving Generalization.	6
3.	Decision Tree Learning	Decision Tree Representation, Construction of Decision Trees: Entropy Impurity, Variance Impurity, Misclassification Impurity. Axis-Parallel and Oblique Decision Trees, Issuesin decision tree learning.Random Forests	9

4.	Data Clustering	Unsupervised learning, Basic clustering methods, Principal component analysis for feature reduction	6
5.	Support Vector Machines	Linear maximum margin classifier for linearly separable data, Linear soft margin classifier, Kernel induced feature spaces, Nonlinear classifiers, Regression by SVM, SVM variants.	10
		Total number of Lectures	**41**

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.	Applied Machine Learning, M. Gopal, McGraw Hill, 2018.
2.	Machine Learning: The New AI, E. Alpaydin, The MIT Press Essential Knowledge series, 2016.
3.	Machine Learning Yearning , Andrew Ng, Deeplearning.ai,2018.
4.	The Elements of Statistical Learning , T. Hastie, R. Tibshirani, J. Friedman., 2nd Edition, Springer,2008.
5.	Machine Learning, T. Mitchell, McGraw Hill, 1997.
6.	Pattern Recognition and Machine Learning, C.M. Bishop, 2nd Edition, Springer, 2011.

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M11EC118	**Semester Odd (specify Odd/Even**	**Semester** 1st **Session** 2020-2021 **Month from July to December**
Course Name	ADVANCED DIGITAL SIGNAL PROCESSING(CO code : C110)		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vineet Khandelwal
	Teacher(s) (Alphabetically)	NIL

COURSE OUTCOMES At the end of the semester, students will be able to		**COGNITIVE LEVELS**
CO1	Recall the principles of various transform techniques like Z, Chirp Z, Hilbert, Discrete Fourier transform and Fast Fourier Transform.	Applying Level (C3)
CO2	Demonstrate the ability to apply different methods to design and analyze digital FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters with its structural realization.	Analyzing Level(C4)
CO3	Analyze Multirate signal processing and examine its application.	Analyzing Level(C4)
CO4	Comprehend different methods for designing adaptive filters and examine its application	Analyzing Level(C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Review of Digital Signal Processing**	Review of discrete–time sequences and systems, Linear Shift Invariant (LSI) systems. Causality and Stability Criterion, FIR & IIR representations, Z-Transform, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques, Chirp Z- Transform, Hilbert Transform and applications	6

2.	**Design of IIR and FIR Filters**	Digital filter specifications, selection of filter type, and filter order, FIR filter design; using windowing Techniques, Fourier Series and frequency sampling method, Design of IIR Filters Using Butterworth, Chebyshev and Elliptic Approximations, Frequency Transformation Techniques; approximation of derivatives, Impulse invariant method, Bilinear transformation, Structures for IIR Systems – Direct Form I & II, Cascade, Parallel, Lattice & Lattice-Ladder Structures, Structures For FIR Systems – Direct , Cascade, Parallel, Lattice & Lattice ladder Structures.	12
3.	**Multirate Digital Signal Processing**	Decimation & Interpolation, Sampling rate conversion, Identities, polyphase decomposition, General polyphase framework for Decimator and Interpolator, Multistage decimator and Interpolator, Efficient transversal structure for Decimator and Interpolator, FIR and IIR structure for Decimator, Filter design for FIR decimator and Interpolator, Application of Multirate Signal processing.	14
4.	**Adaptive Filters**	Introduction, Application of adaptive filters, correlation structure, FIR Weiner Filter, Adaptive Direct-form FIR filters Adaptive Lattice-Ladder filters, Introduction to linear prediction, linear prediction and autoregressive modeling.	10
		Total number of Lectures	42

Evaluation Criteria

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

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

1.	J.G. Proakis & D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", 4th Edition, PHI, 2012
2.	Aurelio Uncini, "Fundamentals of Adaptive Signal Processing", Springr Nature, Jan 2015.
3.	Tulay Adah and Simon Haykins, "Adaptive Signal Processing: Next Generation Solutions", Wiley India, 2012.

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M12EC123	**Semester** :Odd 2020**(specify Odd/Even)**	**Semester** I **Session** 2020 -2021 **Month from Aug 2020 – Dec 2020**
Course Name	Information theory and Coding		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Ankit Garg
	Teacher(s) (Alphabetically)	Dr. Ankit Garg

COURSE OUTCOMES		**COGNITIVE LEVELS**
C140.1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understanding [Level II]
C140.2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analyzing [Level IV]
C140.3	Analyze the need for channel coding in digital communication systems, the relationship between bandwidth and capacity of communication channels with its importance in real life communication systems.	Analyzing [Level IV]
C140.4	Generate block codes for error detection and correction.	Analyzing [Level IV]
C140.5	Generate convolutional codes for error detection and correction.	Analyzing [Level IV]

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.	3

		Weak law of large numbers.	
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 2008.
3.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2008.
4.	S. LIN & D.J. COSTELLO: Error Control Coding, 2ndEdn, Pearson, 2004.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**19M12EC112**	**Semester Odd semester (specify Odd/Even)**	**Semester 1ST Session 2020-21** Month from August 2020 to Dec 2020.
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**
CO120. 1	Explain soft computing techniques and their roles in building intelligent machines	Understanding Level (C2)
CO120.2	Apply neural networks to pattern classification and regression problems	Applying Level (C3)
CO120.3	Apply fuzzy logic and genetic algorithms to handle uncertainty and optimization problems	Applying Level (C3)
CO120.4	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	**17M22EC116**	**Semester (Odd)**	**Semester I** **Session –** 2020-21 **Month** Aug 2020 to Dec 2020
Subject Name	**DSP Architecture**		
Credits	3	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Madhu Jain
	Teacher(s) (Alphabetically)	Dr. Madhu Jain

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
CO1	Recall the concepts of Digital Signal Processing and study the computational building blocks of DSP Processor	Understanding Level (C2)
CO2	Understand the various addressing modes, peripherals, interrupts and pipelining structure of DSP processor	Understanding Level (C2)
CO3	Implementation and applications of DSP Processor	Applying Level (C3)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Introduction to digital signal processing	Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.	5
2.	Architectures for programmable digital signal-processors	Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and	8

		Program Execution, Features for External Interfacing.	
3.	Programmable digital signal processors	Introduction, Commercial digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control.	6
4.	Detail Study of TMS320C54X & 54xx	Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.	6
5.	Implementation of basic DSP algorithms	Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters	6
6.	Implementation of FFT algorithms	Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx.	6
7.	Interfacing and applications of DSP processor	Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.	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**

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

1. Digital Signal Processing, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

2. Digital Signal Processing: A practical approach, Ifeachor E. C., Jervis B. W Pearson- Education, PHI/ 2002

3. Digital Signal Processors, B Venkataramani and M Bhaskar TMH, 2002

4. Architectures for Digital Signal Processing, Peter Pirsch John Weily, 2007