

DEPARTMENT OF ECE

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	Pattern recognition and computational intelligence		
Course Code	EC628	No. of Credits	3
Course Code of Pre-requisite subject(s)	Nil		
Session	Jan.	Section (if, applicable)	Nil
Name of Faculty	Dr.E.S.Gopi	Department	ECE
Email	esgopi@nitt.edu	Telephone No.	9500423313
Name of Course Coordinator(s) (if, applicable)			
E-mail	govivasig@gmail.com	Telephone No.	914312503314
Course Type	<input type="checkbox"/> Core course	<input checked="" type="checkbox"/> Elective course	
Syllabus (approved in BoS)			
Polynomial curve fitting – The curse of dimensionality - Decision theory - Information theory - The beta distribution - Dirichlet distribution-Gaussian distribution-The exponent family: Maximum likelihood and sufficient statistics -Non-parametric method: kernel-density estimators - Nearest neighbour methods. Linear models for regression and classification: Linear basis function models for regression - Bias variance decomposition-Bayesian linear regression-Discriminant functions - Fisher's linear discriminant analysis (LDA) - Principal Component Analysis (PCA) - Probabilistic generative model - Probabilistic discriminative model-Independent Component Analysis (ICA) Kernel methods: Dual representations-Constructing kernels-Radial basis function networksGaussian process-Maximum margin classifier (Support Vector Machine) –Relevance Vector Machines-Kernel-PCA, Kernel-LDA. Mixture models: K-means clustering - Mixtures of Gaussian - Expectation-Maximization algorithm-Sequential models: Markov model, Hidden-Markov Model (HMM) - Linear Dynamical Systems (LDS). Neural networks: Feed- forward Network functions-Network training - Error Back propagation - The Hessian Matrix - Regularization in Neural Network - Mixture density networks – Bayesian Neural Networks - Particle swarm optimization-Genetic algorithm-Ant colony optimizationBacterial foraging-Simulated annealing – Fuzzy logic systems			
COURSE OBJECTIVES			
The subject aims to make the students to understand the mathematical approach for pattern recognition and computational intelligence.			
COURSE OUTCOMES (CO)			
Course Outcomes	Aligned Programme Outcomes (PO)		
PO1: Post graduates of communication engineering programme will demonstrate deep knowledge with an ability to discriminate, evaluate, analyse and synthesize existing and new knowledge in telecommunication engineering and the related mathematics.			

- M. Tech - 2nd Semester

PO11: Post graduates should be capable of self-education and clearly understand the value of achieving perfection by learning by mistakes without depending on external feedback.			
At the end of the course student will be able to,			
CO1: summarize the various techniques involved in pattern recognition.			PO1
CO2: identify the suitable pattern recognition techniques for the particular applications.			PO1,PO11
CO3: categorize the various pattern recognition techniques into supervised and unsupervised			PO1
CO4: summarize the mixture models based pattern recognition techniques			PO1
CO5: summarize the various computational intelligence techniques for pattern recognition.			PO1
COURSE PLAN – PART II			
COURSE OVERVIEW			
The subject aims to make the students to understand the mathematical approach for pattern recognition and computational intelligence. The subject deals with Polynomial curve fitting, Linear and Non-linear model for regression and classification. Kernel methods. Mixture models and Biologically inspired algorithms such as Back propagation Neural network, Particle swarm optimization, etc			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week /Contact Hours	Topic	Mode of Delivery
1	1	Linear model for regression and classification. Polynomial curve fitting The curse of dimensionality Decision theory	Lecture using board and slide presentation
2	2	Information theory The beta distribution Dirichlet distribution, Gaussian distribution The exponent family	Lecture using board and slide presentation
3	3	Maximum likelihood and sufficient statistics. Non parametric method: kernel density estimators Nearest neighbor methods	Lecture using board and slide presentation
4	4	Linear basis function models for regression Bias variance decomposition Linear basis function models for regression Bias variance decomposition	Lecture using board and slide presentation
5	5	Bayesian linear regression Discriminant functions.	Lecture using board and slide presentation

6	6	Fisher's linear discriminant analysis (LDA) Principal Component Analysis (PCA) -	Lecture using board and slide presentation
5	7	Probabilistic generative model Probabilistic discriminative model Independent Component Analysis (ICA)	Lecture using board and slide presentation
6	8	Flipped class 1	Think pair share activity, followed by assessment based on Flipped class 1
7	8	Kernel methods: Dual representations Constructing kernels Radial basis function networks Gaussian process Maximum margin classifier (Support Vector Machine)	Lecture using board and slide presentation
8	9	Relevance Vector Machines Kernel PCA, Kernel LDA.	Lecture using board and slide presentation
10	10	Neural networks: Feed forward Network functions Network training Error Back propagation The Hessian Matrix	Lecture using board and slide presentation
11	11	Flipped class 2	Think pair share activity, followed by assessment based on Flipped class 2
12	11	Regularization in Neural Network Mixture density networks Bayesian Neural Networks	Lecture using board and slide presentation
13	12	Mixture models: K-means clustering Mixtures of Gaussian	Lecture using board and slide presentation
14	13	Expectation Maximization Algorithm	Lecture using board and slide presentation
15	14	Sequential models: Markov model, Hidden Markov Model (HMM) Linear Dynamical Systems (LDS)	Lecture using board and slide presentation
16	14	Particle swarm optimization Genetic algorithm,	Lecture using board and slide presentation
17	15	Ant colony optimization, Bacterial foraging,	Lecture using board and slide presentation

18	15	Simulated annealing Fuzzy logic systems	Lecture using board and slide presentation
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COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Quiz 1	During 13/2/ to 16/2	1 hour	15%
2.	Quiz 2	During 20/3 to 23/3	1 hour	15%
CPA	Compensation Assessment	17/4 to 23/4		
3.	Assessment based on flipped class	Contionous assessment	NA	10%
4	Min project submission	Audio slide presentation	NA	10%
5	End semester exam	During 24/4/ to 14/5	3 hours	50%

*mandatory; refer to guidelines on page 4

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Self-assessment feedback by the students
2. Overall performance of the students in the assessment

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc)
esgopi@nitt.edu, 9500423313

ATTENDANCE

Minimum attendance requirement is 75% to write the end semester exam

COMPENSATION ASSESSMENT

[1] Compensation assessment will be conducted for those who missed either Quiz1 or Quiz 2 (Not both). Portions for the compensation assessment: Quiz: 1 + Quiz 2 portions

ACADEMIC HONESTY & PLAGIARISM

Copying is strictly not allowed for submitting the project audio slide. However discussion with the peers is allowed.

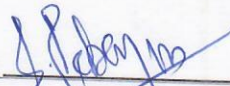
ADDITIONAL INFORMATION

FOR APPROVAL

Course Faculty



CC-Chairperson



HOD



(Dr. B. Rebekka)