NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech. (Common to 3rd and 4th year)**		
Course Title	**Pattern recognition (Elective course)**		
Course Code	**ECPE22**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**Nil.**		
Session	**JULY 2020**	**Section (if, applicable)**	**Not applicable**
Name of Faculty	**Dr.E.S.Gopi**	**Department**	**ECE**
Official Email	**esgopi@nitt.edu**	**Telephone No.**	**9500423313**
Name of Course Coordinator(s) (if, applicable)	**Not applicable**		
Course Type	**Programme 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.

Kernel methods: Dual representations-Constructing kernels-Radial basis function networks-Gaussian 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

COURSE OBJECTIVES

The subject aims to make the students to understand the mathematical approach for pattern recognition.

MAPPING OF COs with POs	
Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
At the end of the course student will be able to, 1. CO1: summarize the various techniques involved in pattern recognition.	**PO1**
2. CO2: identify the suitable pattern recognition techniques for the particular applications.	**PO1, PO11**
3. CO3: categorize the various pattern recognition techniques into supervised and unsupervised	**PO1**
4. CO4: summarize the mixture models based pattern recognition techniques	**PO1**
5. CO5: summarize the Artificial Neural network techniques	**PO1**

COURSE PLAN – PART II

COURSE OVERVIEW

The subject aims to make the students to understand the mathematical approach for pattern recognition. The subject deals with Polynomial curve fitting, Linear and Non-linear model for regression and classification. Kernel methods. Mixture models and Neural networks.

COURSE TEACHING AND LEARNING ACTIVITIES **(** Add more rows)

S.No.	Week/Contact Hours (4)	Topic	Mode of Delivery
1	**1**	Linear model for regression and classification**.** Polynomial curve fitting The curse of dimensionality Decision theory	**Lecture using online presentation and power point presentation**
2	**2**	Information theory The beta distribution Dirichlet distribution Gaussian distribution The exponent family	**Lecture using online presentation and power point presentation**
3	**3**	Maximum likelihood and sufficient statistics. Non parametric method: kernel density estimators Nearest neighbor methods	**Lecture using online presentation and power point presentation**
4	**4**	Linear basis function models for regression Bias variance decomposition Linear basis function models for regression Bias variance decomposition	**Lecture using online presentation and power point presentation**

5	**5**	Bayesian linear regression Discriminant functions.	**Lecture using online presentation and power point presentation**
6	**6**	Fisher's linear discriminant analysis (LDA) Principal Component Analysis (PCA) -	**Lecture using online presentation and power point presentation**
5	**7**	Probabilistic generative model Probabilistic discriminative model	**Lecture using online presentation and power point presentation**
6	**8**	Independent Component Analysis (ICA)	**Lecture using online presentation and power point presentation**
7	**8**	**Flipped class 1**	**Think pair share activity, followed by assessment based on Flipped class 1**
8	**9**	Kernel methods: Dual representations Constructing kernels)	**Lecture using online presentation and power point presentation**
10	**10**	Radial basis function networks Gaussian process Maximum margin classifier (Support Vector Machine	**Lecture using online presentation and power point presentation**
11	**11**	Relevance Vector Machines Kernel PCA, Kernel LDA.	**Lecture using online presentation and power point presentation**
12	**11**	**Flipped class 2**	**Think pair share activity, followed by assessment based on Flipped class 2**
13	**12**	Neural networks: Feed forward Network functions Network training Error Back propagation The Hessian Matrix	**Lecture using online presentation and power point presentation**
14	**13**	Regularization in Neural Network Mixture density networks Bayesian Neural Networks	**Lecture using online presentation and power point presentation**

COURSE ASSESSMENT METHODS (shall range from 4 to 6)				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	Online Quiz 1	1st week of October	1 hour	15%
2.	Online Quiz 2	2nd week of November	1 hour	15%
3.	Assessment based on flipped class	Contionous assessment	-	10%
4	Min project submission	Contionous assessment (Audio slide presentation)	-	10%
CPA	Compensation Assessment*			
5	Online Quiz 3	3rd week of November	1 hour	15%
6	Online Final Assessment *	4th week of November	2 hours	30%

***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 (including compensation assessment to be specified**)**

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

[2] The course shall have a final assessment on the entire syllabus with 30% weightage.

[3] Those who missed either Quiz 1 or Quiz 2 for genuine reason are allowed to write Quiz 3 as the Compensation Assessment. The syllabus for the Quiz 3 is the combination of Quiz 1 and Quiz 2 portions. (Only genuine cases of absence shall be considered).

[4] The passing minimum shall and other policy are as per the regulations.

ATTENDANCE POLICY (including compensation assessment to be specified)

- **At least 75% attendance in each course is mandatory.**
- **Students with less than 75% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.**
- **A maximum of 10% shall be allowed under ONDUTY (OD) Category**

ACADEMIC DISHONESTY & PLAGIARISM

- **Copying from others during an online assessment will be treated as punishable dishonesty.**
- **Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.**
- **The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty.**
- **The report shall be submitted to the Academic office**

ADDITIONAL INFORMATION, IF ANY

Interaction through piazza (www.piazza.com) is mostly encouraged.

Essential readings:

1. R.B.Ash, "Information theory", Wiley, 1965
2.H.V.Poor, "An Introduction to Signal Detection and Estimation",(2/e),Spriner verlag, 1994
3.J.G.Proakis, D G Manolakis, "Digital Signal Processing" (4/e), Pearson Education, 2007
4. E.S.Gopi, "Digital Signal Processing for Wireless Communication using Matlab", Springer publication, 2015

FOR APPROVAL

Course Faculty _____ **CC- Chairperson** _____ **HOD** _____