NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech.**		
Course Title	**Pattern recognition (Programme Elective)**		
Course Code	**ECPE22**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**Nil**		
Session	**July 2019**	**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	**Global 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**	**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	**Lecture using board and slide presentation**
6	8	Independent Component Analysis (ICA)	**Lecture using board and slide presentation**
7	8	**Flipped class 1**	**Think pair share activity**
8	9	Kernel methods: Dual representations Constructing kernels)	**Lecture using board and slide presentation**
10	10	Radial basis function networks Gaussian process Maximum margin classifier (Support Vector Machine	**Lecture using board and slide presentation**
11	11	Relevance Vector Machines Kernel PCA, Kernel LDA.	**Lecture using board and slide presentation**
12	11	**Flipped class 2**	**Think pair share activity**
13	12	Neural networks: Feed forward Network functions Network training Error Back propagation The Hessian Matrix	**Lecture using board and slide presentation**

14	13	Regularization in Neural Network Mixture density networks Bayesian Neural Networks	**Lecture using board and slide presentation**

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	**Quiz 1**	**During 16/09/ to 20/09**	**1 hour**	**15%**
2.	**Quiz 2**	**During 14/10 to 18/10**	**1 hour**	**15%**
3.	**Assessment based on flipped class Min project submission**	**Contionous assessment (Audio slide presentation)**		**20%**
CPA	**Compensation Assessment***			
4.	**Quiz 3 (Compensation Assessment)**	**During 11/11 to 15/5**	**1 hour**	**15%**
5.	**Final Assessment ***	**During 18/11 to 22/11**	**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 (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] Minimum attendance requirement is 75% to write the end semester exam.

[3] Other policy is as per the institute norms.

[4] Those whos 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.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an 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.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

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

Essential readings:

1. C.M.Bishop,"Pattern recognition and machine learning",Springer,2006
2. E.S.Gopi, „"Pattern recognition and the computaltional intelligence techniques using Matlab, Springer ,2020.
https://www.springer.com/gp/book/9783030222727#otherversion=9783030222734
3. Sergious Thedorodis ,Konstantinos Koutroumbas, Patternrecognition, Elsevier, Fourth edition,2009
4.J.I.Tou and R.C.Gonzalez, ``Pattern recognition and Machine learning'', Addition-Wesley, 1977
5.P.A.Devijer and J.Kittler, ``Pattern recognition-A statistical Approach", Prentice-Hall, 1990
6.R.Schalkoff, ``Pattern recognition-statistical ,structural and and Neural approaches",-John Wiley, 1992
7. Recent literature in Pattern recognition and computational intelligence.

FOR APPROVAL

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

(DR. E.S.GOPI)

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.