NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE OUTLINE			
Course Title	Statistical theory of communication (5th semester ECE) 'A' Section		
Course Code	[redacted] EC PC19	No. of Credits	4
Department	ECE		Dr. E.S. Gopi
Pre-requisites Course Code	Probability theory and Random process (MA 206)		
Course Coordinator(s) (if, applicable)	-Nil-		
Other Course Teacher(s)/Tutor(s) E-mail	esgopi@nitt.edu	Telephone No.	9500423313
Course Type	Core course		

COURSE OVERVIEW

Information measure. Discrete entropy. Joint and conditional entropies. Uniquely decipherable and instantaneous codes. Kraft-McMillan inequality. Noiseless coding theorem. Construction of optimal codes.

Discrete Memoryless Channel. Mutual information and channel capacity. Shannon's fundamental theorem. Entropy in the continuous case. Shannon-Hartley law.

Binary hypothesis testing. Baye's, minimax and Neyman-Pearson tests. Random parameter estimation-MMSE, MMAE and MAP estimates. Nonrandom parameters – ML estimation.

Coherent signal detection in the presence of additive white and non-white Gaussian noise. Matched filter.

Discrete optimum linear filtering. Orthogonality principle. Spectral factorization. FIR and IIR Wiener filters.

COURSE OBJECTIVES	
The subject aims to make the students to understand the statistical theory of telecommunication which are the basics to learn analog and digital telecommunication.	
COURSE OUTCOMES (CO)	
Course Outcomes (COs)	**Aligned Programme Outcomes (POs)**
At the end of the course student will be able to **CO1: show how the information is measured and able to use it for effective coding** **CO2:summarize how the channel capacity is computed for various channels** **CO3:use various techniques involved in basic detection and estimation theory to solve the problem** **CO4:summarize the applications of detection theory in telecommunication** **CO5:summarize the application of estimation theory in telecommunication**	**PO1 (High): Post graduates of communication engineering programme will demonstrate deep knowledge with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge in telecommunication engineering and the related mathematics.**

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week	Topic	Mode of Delivery
1	1	Information measure. Discrete entropy. Joint and conditional entropies.	**Chalk and talk method**
2	2	Uniquely decipherable and instantaneous codes. Construction of optimal codes	**Chalk and talk method**
3	2	Kraft-Mcmillan inequality and Noiseless coding theorem.(Flipped class) http://silver.nitt.edu/~esgopi/Videolectures/STATISTICAL_THEORY_OF_COMMUNICATION/Noiselesscodingtheorem.mp4	**Problem solving through Think-Pair-Share**

10	6	MMSE,MMAE and MAP estimates	**Chalk and talk method**
11	7	Example for MMSE,MMAE and MAP estimate	**Chalk and talk method**
12	8	Demonstration for MMSE,MMAE and MAP estimate	**Demonstration using LCD projector**
12	8	Coherent signal detection in the presence of additive white and non-white Gaussian noise	**Chalk and talk method**
13	8	Matched filter	**Chalk and talk method**
14	8	Pre-whitening filter for the Discrete case	**Chalk and talk method and followed by demonstration.**
15	9	FIR Wiener filter	**Chalk and talk method**
16	9	FIR Wiener filter demonstration	**Demonstration using LCD projector**
17	10	IIR Wiener filter	**Chalk and talk method**
16	10	IIR Wiener filter demonstration	**Demonstration using LCD projector**

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	**Cycle test 1**	**August last week**	**1 hour**	**15%**
2	**Cycle test 2**	**October first week**	**1 hour**	**15%**
3	**Assignment 1 – Based on submission of solved problems**	**Continuous assessment**	**----------**	**10%**
4	**Assignment 2- Audio slide preparation (Illustrations based on the learned concepts).**	**First week of November**	**----------**	**10%**

5	End semester exam	Second week of November	3 hours	50%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

[1] R.B.Ash," Information Theory", Wiley,1965.
[2] H.V.Poor, "An Introduction to Signal Detection and Estimation,(2/e)", Spring 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

Video lectures:
http://silver.nitt.edu/~esgopi/Videolectures/STATISTICAL_THEORY_OF_COMMUNICATION/

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

Using self-assessment course feedback

Attainment consists of two components

1. **Fractional number of students those who obtained greater than C grade (50%)**
2. **Self-assessment feedback (50%)**

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. **Assignment 1 and 2 should be submitted individually (copying is strictly not allowed). Discussion with the class mates are allowed.**
2. **Retest is allowed only for those who missed the Cycle test for the valid reason.**
3. **Penalty for plagiarism, Attendance are as per the general institute policy.**

ADDITIONAL COURSE INFORMATION

eg.: Make use of piazza for https://piazza.com/account/login discussion and assignment submission.

FOR SENATE'S CONSIDERATION

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