



COURSE: Modern Theory of Detection and Estimation		
DEGREE: Communication Systems / Telematics Engineering	YEAR: 3rd	T: 1st

La asignatura tiene 29 sesiones que se distribuyen a lo largo de 14 semanas. Los laboratorios pueden situarse en cualquiera de ellas. Semanalmente el alumno tendrá dos sesiones, excepto en un caso que serán tres.

PLANIFICACIÓN SEMANAL DE LA ASIGNATURA									
WEEK	SESSION	DESCRIPTION	GROUPS (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	Indicate YES/NO If the session needs 2 teachers	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINARS			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h week)
1	1	Course overview Block 0 – Introduction to statistical learning <ul style="list-style-type: none"> • Estimation and classification concepts • Application examples • Previous knowledge • Review problems regarding integral calculus and random variables 	X				Random variable and calculus review Reading to be determined	1,66	5
1	2	<ul style="list-style-type: none"> • Introduction to Python 		X	Computer Lab		Previous work about the lab topic	1,66	
2	3	Block 1 - Introduction to the classification problem <ul style="list-style-type: none"> • Decision case without observations: calculation of a prior probabilities, decision of maximum probability, costs and minimum cost decision • Decision case with observations: a posterior probabilities, MAP decision, minimum cost decision, average cost 	X				Reading to be determined Review of the discussed concepts	1,66	6

2	4	<ul style="list-style-type: none"> • Introduction to Python: Numpy and Matplotlib 		X	Computer Lab		Previous work about the lab topic	1,66	
3	5	Formalization of the decision problem based on observations: <ul style="list-style-type: none"> • Decision makers characterization. • Decision maker concept • Concept of likelihood • PFA, PM, Pd • Perror and Pacierto • Calculation of the average cost • Decision makers design: ML and MAP criteria 	X				Reading to be determined Review of the discussed concepts	1,66	6
3	6	<ul style="list-style-type: none"> • Decision problems 		X			Problems to be determined	1,66	
4	7	<ul style="list-style-type: none"> • Likelihood ratio test: particular cases (ML, MAP, minimum average cost, N-P) • Threshold decision makers • Decision problems 	X				Reading to be determined Review of the discussed concepts Problems to be determined	1,66	6
4	8	<ul style="list-style-type: none"> • Lab session: Classification 1 		X	Computer Lab		Previous work about the lab topic	1,66	
5	9	<ul style="list-style-type: none"> • Discriminant function • Characterization of decision families through ROC • Decision problems 	X				Reading to be determined Review of the discussed concepts Problems to be determined	1,66	6
5	10	<ul style="list-style-type: none"> • Lab session: Classification 2 		X	Computer Lab		Previous work about the lab topic	1,66	
6	11	<ul style="list-style-type: none"> • Decision problems 	X				Problems to be determined	1,66	
6	12	<ul style="list-style-type: none"> • Lab session: Classification 3 		X	Computer Lab		Previous work about the lab topic	1,66	6
7	13	<ul style="list-style-type: none"> • Decision problems 	X				Problems to be determined	1,66	
7	14	<ul style="list-style-type: none"> • Block 1 exam (1 point) 		X			Preparation of the evaluation test	1,66	6
8	15	<ul style="list-style-type: none"> • Block 2 - Estimation and Filtering • Overview of the estimation problem • Characterization and design of estimators <ul style="list-style-type: none"> - Characterization: Calculation of average cost - Design: Minimization of average cost - Estimators MSE, MAD, MAP 	X				Reading to be determined Review of the discussed concepts	1,66	6
8	16	<ul style="list-style-type: none"> • Estimation problems. 		X			Problems to be determined	1,66	
9	17	<ul style="list-style-type: none"> • Design of estimators with restrictions: case without restrictions vs. case with restrictions • LMSE estimate 	X				Reading to be determined Review of the discussed concepts Problems to be determined	1,66	6
9	18	<ul style="list-style-type: none"> • Estimation problems. 		X			Problems to be determined	1,66	

10	19	<ul style="list-style-type: none"> Estimation with Gaussian distributions ML estimate <ul style="list-style-type: none"> Case with two variables / random vectors ML estimation of the parameters of a dpp from i.i.d. observations 	X				Reading to be determined Review of the discussed concepts Problems to be determined	1,66	5
10	20	<ul style="list-style-type: none"> Lab session: Estimation 1 		X	Computer Lab		Previous work about the lab topic	1,66	
11	21	<ul style="list-style-type: none"> Estimation problems. 	X				Problems to be determined	1,66	
11	22	<ul style="list-style-type: none"> Lab session: Estimation 2 		X	Computer Lab		Previous work about the lab topic	1,66	6
12	23	<ul style="list-style-type: none"> ML linear estimation problem subject to Gaussian noise Signal filtering with the previous model: <ul style="list-style-type: none"> Formulation of the signal filtering problem Construction of the observation matrices from the signals Iterative minimization of the average square error: LMS 	X				Reading to be determined Review of the discussed concepts	1,66	6
12	24	<ul style="list-style-type: none"> Lab session: Estimation 3 <ul style="list-style-type: none"> Filtering: ML solution 		X	Computer Lab		Previous work about the lab topic	1,66	
13	25	<ul style="list-style-type: none"> Estimation problems. 	X				Problems to be determined	1,66	5
13	26	<ul style="list-style-type: none"> Lab session: Estimation 4 <ul style="list-style-type: none"> Filtering: LMS solution 		X	Computer Lab		Previous work about the lab topic	1,66	
14	27	<ul style="list-style-type: none"> Block 2 exam (1 point) 	X				Preparation of the evaluation test	1,66	5
14	28	<ul style="list-style-type: none"> Final exam problems (blocks 1 and 2). 		X			Problems to be determined	Problems to be determined	
14	29	<ul style="list-style-type: none"> Lab session: Exam (2 points) 		X	Computer Lab		Preparation of the evaluation test	1,66	3
Subtotal 1								48,33	83
Total 1 (Hours of class plus student homework hours between weeks 1-14)								131,33	
15		Tutorials, handing in, etc							
16		Assessment							
17								3	
18									20
Subtotal 2								3	20
Total 2 (Hours of class plus student homework hours between weeks 15-18)								23	
TOTAL (Total 1 + Total 2. Maximum 180 hours)								154,33	