INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Title	**Detection and Estimation Theory**	Course No				
Department/ Specialization	Electronics & Communication Engineering	Credits	L	T	P	C
			3	1	0	4
Faculty proposing the course	Dr. Appina Balasubramanyam	Status	Core ☐		Elective ■	
Offered for	UG/PG	Type	New		Revision ■	
Recommendation from the DAC: Yes		Date of DAC	12. 11. 2021			
External Experts	Prof. Sumohana S Channappayya, Dept. of EE, IIT Hyderabad					
Prerequisite	Signal processing, Probability	Submitted for approval	46th Senate			
Learning Objectives	In this course, we study the usage of tools from probability and signal processing to detect events, and to estimate signals and parameters from data. In many cases, we obtain optimum detector/estimator and/or identify the (error) performance bounds of any detector/estimator.					
Learning Outcomes	At the end of the course, the learners are expected to do the following: ▪ Formulate various detection problems in hypotheses testing framework. ▪ Analyze various estimation algorithms for their error performance. ▪ Develop algorithms for various estimation problems. ▪ Design various sequential procedures for detection/estimation problems. ▪ Devise algorithms for tracking.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	Review of Probability Theory. (7L+2T) Hypothesis testing: Bayesian, Minimax, Neyman-Pearson, Composite hypothesis testing, generalized likelihood ratio test, uniformly most powerful test. Performance evaluation of detection procedures, sequential detection, non-parametric and robust detection. (13L+5T) Parameter Estimation: Bayesian parameter estimation, sufficient statistics, best linear unbiased estimation, ML estimation, estimation of vector parameters, robust estimation, recursive parameter estimation, Cramer-Rao bound, Rao-Blackwell theorem. (15L+5T) MMSE and MAP estimators, Wiener filter, Kalman filter, Levinson-Durbin and innovation algorithms. (7L+2T)					
Essential Reading	H. V. Poor, An Introduction to Signal Detection and Estimation, 2nd edition, Springer- Verlag, 1994, ISBN: 978-0387941738.					
Supplementary Reading	1. J. P. Romano and E. L. Lehmann, Testing Statistical Hypotheses, 3rd edition, Springer International Edition, 2008, ISBN: 9788184891744. 2. George Casella and Roger L. Berger, Statistical Inference, Second Edition. Cengage Learning, 2002.					