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

INTRODUCTION OF NEW COURSE

Course Title	Adaptive Filter Design	Course No *(to be assigned by Academic Cell)*				
Specialization	Signal Processing & Communication	Structure (LTPC)	3	0	0	3
To be offered for	ESD, EDM, EDS, M. Des.- Communication Systems	Status	Core ☐		Elective ■	
Faculty Proposing the course	Dr. Asutosh Kar	Type	New ■		Modification ☐	
Pre-requisite	Signal & Systems	Submitted for approval	_____ Senate			
Learning Objectives	This course covers various aspects of adaptive filter theory along with applications in modern communication system design for channel equalization, echo cancellation, active noise control and feedback reduction which are the prime focus of signal processing industries all over the world.					
Learning Outcomes	• Students will come to know state-of-the-art applications of adaptive filters for solving real-time industrial problems which will motivate them for further research in the field of signal processing and communication. • The design aspect of adaptive filter will help them to realize the filter design applying the previously studied signal & systems. Hence, it will increase their interest on application based studies.					
Contents of the course *(With approximate break up of hours)*	Introducing the course with brief background of modern signal analysis and representation techniques, stochastic signal processing, spectrum analysis, probability theory & noise analysis, analog vs. digital filters. (8 Hrs.) Practical characterization of stochastic process, LS Estimators, Mean Ergodic Theorem Correlation matrix and properties, AR models-synthesis and analysis, MA and ARMA models Wold's Decomposition, Linear optimum filtering and Wiener-Hopf Equation, Wiener Filter-design and analysis, Characteristics of adaptive algorithms. (12 Hrs.) Gradient search/Newton's algorithm, Steepest descent algorithm and convergence analysis, Adaptive linear combiner, Structure and operation of the Least Mean Square Algorithm, The LMS algorithm and convergence analysis, The NLMS algorithm, LMS Vs. Steepest-Descent Algorithm, Last Square methods and RLS algorithm, Structure optimization of adaptive filter. (15 Hrs.) Acoustic Noise Cancellation, Channel Equalization, Acoustic Echo Cancellation, Adaptive feedback cancellation in hearing aids, Kalman filters and time-frequency analysis. (6 Hrs.)					
Text Books	1. Simon Haykin, *Adaptive Filter Theory*, Pearson Education, Fourth Edition, 2002. 2. B. Widrow, S.D. Strearns, Adaptive Signal Processing, Pearson, 2002.					
Reference Books	1. Manolakis, D., Ingle, M., Kogon, S., *Statistical and Adaptive Signal Processing*, McGraw-Hill, 2000. 2. Monson H. Hayes, *Statistical Digital Signal Processing and Modeling*, Wiley-India, 2008.					

Justification of proposing this course

1. The core course of advanced digital signal processing for ESD does not offer any chapter on adaptive filter theory.
2. After referring to the syllabus of almost all IITs and reputed NITs it can be found that the ADSP course covers mainly adaptive filtering. If not, then they have an elective course of adaptive filter theory.
3. Adaptive filters have various important applications in modern signal processing and communication system designs. Almost all signal processing industries are looking for experts in adaptive filtering as it has application for channel equalization, audio signal processing, biomedical signal processing, optimization of digital filters etc.
4. Being a design and manufacturing institute our students should be able to address real industrial problems once they pass-out.