Course Code	ECE5XX
Course Name	Transform Learning and Applications
Credits	4
Course Offered to	UG/PG
Course Description	Transform learning (TL) is currently an active research area and is being explored in several

Pre-requisites	
Pre-requisite (Mandatory)	**Pre-requisite (Desirable)**
MTH100 Maths I	None
*Please insert more rows if required	

Post Conditions			
CO1	**CO2**	**CO3**	**CO4**
Students are able to model physical problems.	Students will be able to do signal and image analysis using transform learning	Students are able to understand and present current research papers published in top-tier journals and conferences in this area	Students are able to do advanced project work in this area

Weekly Lecture Plan		
Week Number	**Lecture Topic**	**Assignment/Labs/Tutorial**
Week 1	Mathematical preliminaries: Signal spaces and operators, concept of basis, orthogonal and biorthogonal basis, inner product, norm, Frames, Riesz basis	
Week 2	Introduction to transforms, Sampling rate conversions, upsampling and downsampling, 1-D discrete wavelet transform, example of Haar wavelet with connection to filterbank	
Week 3	Computational efficiency in realizing filterbanks- Polyphase components	
Week 4	Lifting Framework of wavelet Designing	
Week 5	2-D separable and non-separable wavelet transform, Integer wavelet transform; Ridgelets, Curvelets, and directional filterbanks	
Week 6	Dyadic Wavelet Transform Learning in forward and inverse problems	
Week 7	Rational Wavelet Transform Learning in forward and inverse problems	
Week 8	Learning Sparsifying Filterbanks	
Week 9	Deep Transform Learning- Recent approaches	
Week 10	Sprasifying Transform Learning- Online learning, overcomplete learning, High dimensional learning; recent approaches	
Week 11	Recent approaches to transform leraning continued…	
Week 12	Student Paper Presentations	
Week 13	Student Project Presentations	

Weekly Lab Plan- Not required explicitly		
Week Number	**Laboratory Exercise**	**Platform (Hardware/Software)**
*Please insert more rows if required		

Assessment Plan	
Type of Evaluation	**% Contribution in Grade**
Assignment	20
Mid-sem	20
End-sem	20
Project	40

Resource Material	
Type	**Title**
Textbook	
Reference	C. S. Burrus, R. A. Gopinath, and H. Guo. Introduction to Wavelets and Wavelet Transforms - A Primer. Prentice Hall, 1997.
Internet Resource	Research Papers by Yoram Bresler's and Elad's Group
Internet Resource	Research Papers by Anubha Gupta's Group and Angshul Majumdar's Group