

# 13-EC529 MULTIRATE SIGNAL PROCESSING

## SYLLABUS

Fundamentals of Multirate Theory: The sampling theorem - sampling at sub-Nyquist rate - Basic Formulations and schemes - Basic Multirate operations- Decimation and Interpolation - Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation - Maximally decimated filter banks: Polyphase. representation - Errors in the QMF bank- Perfect Reconstruction (PR) QMF Bank - Design of an alias free QMF Bank M-channel perfect reconstruction filter banks: Uniform band and non uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation- perfect reconstruction systems Perfect reconstruction (PR) filter banks: Para-unitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property- Quantization Effects: -Types of quantization effects in filter banks. - coefficient sensitivity effects, dynamic range and scaling. Cosine Modulated filter banks: Cosine Modulated pseudo QMF Bank- Alias cancellation- phase - Phase distortion- Closed form expression- Polyphase structure- PR Systems.

## TEXT BOOKS

1. P.P. Vaidyanathan. "Multirate systems and filter banks." Prentice Hall. PTR.
2. N.J. Fliege. "Multirate digital signal processing ." John Wiley.
3. Sanjit K. Mitra. " Digital Signal Processing: A computer based approach."

## REFERENCES

4. R.E. Crochiere. L. R. "Multirate Digital Signal Processing", Prentice Hall. Inc.
5. J.G. Proakis. D.G. Manolakis. "Digital Signal Processing: Principles. Algorithms and Applications", 3rd Edn. Prentice Hall India