Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.Tech. (DEAC) DEGREE END SEMESTER EXAMINATION APRIL 2018

SUBJECT: ADVANCE DIGITAL SIGNAL PROCESSING (ECE - 5202)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A. Illustrate the basic operation of decimation. Certain signal x(n) band limited to B Hz is decimated by a factor M. Obtain and plot the spectrum of the decimated signal (Assume suitable spectrum for x(n)). Explain the effects when $B < \pi/M$ and $B > \pi/M$
- 1B. Derive poly-phase filter structure. Obtain the most efficient filter structure for the fractional rate converter which down samples by the factor 1.5.
- 1C. Obtain the specifications of the decimation filter for 2.048 KHz to 64 Hz down sampler. The signal has pass band of 30 Hz and the overall system should have pass band deviation of 0.01 and stop band attenuation of 60 dB.

(5+3+2)

- 2A. Explain QMF bank. Derive condition for zero aliasing. Obtain the distortion function T(z) for the same.
- 2B. Describe how optimum filter is configured as correlation canceller. Highlight the computation of optimum values for the filter weights.
- 2C. Bring out the trade-off between the convergence speed and numerical accuracy in LMS algorithm.

(5+3+2)

- 3A. With proper signal model and mathematical analysis explain the functioning of adaptive predictor.
- 3B. Describe the functioning of LMS based adaptive echo canceller.
- 3C. Describe use of adaptive filter to improve the SNR of pilot carrier.

(5+3+2)

- 4A. Derive expressions for complex cepstrum of stable exponential signals.
- 4B. Discuss how the complex cepstrum of minimum phase signals are estimated from real cepstrum.
- 4C. Calculate the complex cepstrum of $x(n) = \delta(n) + 0.7\delta(n-10) + 0.49 \delta(n-20)$

(5+3+2)

- 5A. Explain the homo-morphic system for convolution. Find the characteristic function for each block.
- 5B. Explain the computation of Cepstrum using DFT evaluations.
- 5C. Illustrate the effect of spectral leakage due to windowing in PSD estimation.

(5+3+2)

ECE -5202

Page 1 of 1