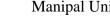
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MANIPAL INSTITUTE OF TECHNOLOGY Manipal University





## FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER **EXAMINATION - NOV/DEC 2016** SUBJECT: DIGITAL SIGNAL PROCESSING (ECE - 303)

## **TIME: 3 HOURS Instructions to candidates**

MAX. MARKS: 50

- Answer ANY FIVE full questions. •
  - Missing data may be suitably assumed.
- 1A. Using unilateral Z-transform solve the difference equation y(n) (1/9)y(n-2) = x(n-1) with y(-1) = x(n-1)1, y(-2) = 0 and x(n) = 2u(n).
- 1B. Find the overall system function of a cascade system having impulse responses  $h_1[n] = 0.5^n u[n]$

and 
$$h_2[n] = \left\{ \begin{array}{ll} 0, & \frac{1}{2}, & -\frac{1}{4} \end{array} \right\}.$$

1C.  $H(z) = \frac{1 - z^{-1} + 2z^{-2} - 3z^{-3}}{(1 - z^{-1})(1 - 0.5z^{-1})(1 - 0.25z^{-1})};$  $|z| \succ 1$ . Consider the function system ii) Sketch the location of the poles in z-domain. i) Is this system stable?

(5+3+2)

- 2A. With relevant mathematical analysis, describe overlap-save method of linear filtering through DFT-**IDFT** calculations.
- 2B. Compute the discrete time Fourier transform and 6 point DFT of the signal

 $x(n) = \{1, 2, 3, 2, 1\}$ 

2C. Define circular shift and circular convolution properties of DFT.

(5+3+2)

- 3A. Derive radix-2 DIF FFT algorithm. Illustrate with signal flow diagram.
- 3B. Develop the Goertzel algorithm for the evaluation of DFT. Mention the computational advantage.
- 3C. Determine the group delay of 11 length linear phase FIR filter.

(5+3+2)

- 4A. Using impulse invariant transformation method, design third order digital Butterworth Low pass filter with cut off frequency 1rad/sec.
- 4B. Explain bilinear transformation method of digitising analog filter.
- 4C. Suggest the location of poles of system function H(z) for a narrow band pass filter with center frequency 100Hz. Assume sampling frequency of 1KHz.

(5+3+2)

- 5A. Compute the coefficients of 11-length digital linear phase FIR low-pass filter with cut-off frequency of 1kHz at sampling frequency of 5kHz. Use causal Hamming window.
- 5B. Explain frequency sampling method of digital FIR filter design.
- 5C. For a FIR filter with 8 length symmetric filter coefficients write the frequency response. Also compute the group dely.

(5+3+2)

6A. Realise the following IIR filter using direct forms 1 and 2 and cascade structures.

$$H(z) = \frac{(1 - 0.2z^{-1})}{(1 + 0.5z^{-1})(1 - 3z^{-1} + 2z^{-2})}$$

- 6B. Explain Bartlet method of PSD estimation.
- 6C. Write the general AR and MA model equations.

(5+3+2)