BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH **SEMESTER : I**
BRANCH: EEE **SESSION : MO/19**

SUBJECT: EE501 ADVANCED DIGITAL SIGNAL PROCESSING

TIME: 3:00 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Differentiate between Energy signal and Power signal. Check whether the corresponding LTI system with system function $H(z) = [(-1-0.4z^{-1}) / (1- 2.8z^{-1}+1.6z^{-2})]$ is stable and causal, if the ROC is (i) $|z| > 2$ (ii) $0.8<|z|> 2$ [5]

Q.1(b) Obtain the direct-form II structure of the system described by difference equation $y(n) = 2r\cos(w_0)\, y(n-1)- r^2y(n-2) + x(n) -r\, \text{Cos}(w_0)\, x(n-1)$. Explain the Chirp Z-transform in brief. [5]

Q.2(a) State the relationship of the Discrete Fourier Transform to Continuous Time Fourier Transform of a sequence x (n). Explain the Short-time Fourier transform in brief. [5]

Q.2(b) An 8-point sequence is given by x (n) = {1, 2, 1, 2, 1, 2, 1, 2}. Compute 8-point DFT of x (n) by radix-2 DIF-FFT algorithm. Show all the intermediate result. Perform linear convolution using circular convolution of the following two sequences x(n) = {2,5,0,4} and h(n)= {4,1,3} [5]

Q.3(a) Describe the magnitude characteristics of Chebyshev filter and elaborate the Chebyshev polynomial recurrence relationship and its graph. [5]

Q.3(b) Design an IIR low-pass Butterworth filter using the bilinear transformation method for the following specifications: [5]
Pass band: $0.8 \le |H(e^{j\omega})| \le 1$ $|\omega| \le 0.2\,\pi$
Stop band: $|H(e^{j\omega})| \le 0.2$ $0.6\,\pi \le |\omega| \le \pi$ (Assume T= 1s)

Q.4(a) Write the differences between Finite Impulse Response and Infinite Impulse Response Filters and compare the different windowing method for Linear-Phase Finite Impulse Response Filters. [5]

Q.4(b) Design a linear-phase FIR digital low-pass digital filter of unity gain using Hamming window whose cut-off frequency is 1.2 rad/sample and length of M=9. Assume the necessary data. [5]

Q.5(a) Explain Von Neumann and SHARC architectures. What is the role of Barrel shifter in DSP processor and implement a 4-bit shift right barrel shifter? [5]

Q.5(b) Explain in detail the pipelining of instruction execution and circular addressing mode used in DSP processor. [5]

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