

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**  
**(END SEMESTER EXAMINATION SP2023)**

**CLASS: M.TECH**  
**BRANCH: ECE**

**SEMESTER : II**  
**SESSION : 2022-23**

**SUBJECT: EC565 ADVANCED DIGITAL SIGNAL PROCESSING**

**TIME: 03 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. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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- Q.1(a) How does the Fourier transform of a discrete time signal differ from that of a continuous time signal? [2]  
Q.1(b) What do you mean by a linear phase filter? Give a suitable impulse response for a linear phase FIR filter. [3]  
Q.1(c) Describe the bilinear transform method for design of a digital filter. [5]
- Q.2(a) Describe the difference between performance gain of discrete Fourier transform and discrete cosine transform. [2]  
Q.2(b) Explain the operation of Haar wavelet Transform. Give an example of this transform. [3]  
Q.2(c) How do you obtain intrinsic mode function (IMF) for a discrete sequence in Hilbert-Huang transform? Explain your answer with the help of a suitable example. [5]
- Q.3(a) How do you obtain  $x(3n/5)$  sequence from a sequence  $x(n)$ ? Explain with the help of a block diagram. [2]  
Q.3(b) How do the down-sampling and up-sampling affect the spectrum of the original signal? What is the solution of such problems in practice? [3]  
Q.3(c) Describe the polyphase sub-sampling method? How does it exhibit performance gain over the simple down-sampling? Explain a 3 phase down sampling for the following sequence: [5]  
 $x(n) = 1, 3, -1, 2, -3, 4, -4, 1, -2.$
- Q.4(a) What is the difference between linear predictor and linear filter? [2]  
Q.4(b) Describe the Yule-Walker equation for linear predictor. [3]  
Q.4(c) How does the Levinson-Durbin recursion help in Yule-Walker equation used in Wiener filter design? [5]
- Q.5(a) How do you obtain power spectra of a random sequence? [2]  
Q.5(b) How does Yule Walker equation help in parametric method for power spectrum estimation? [3]  
Q.5(c) Show that the parametric method leads to a minimum error variance power estimation. [5]

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