

GATE EE23 27

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Question: Which of the following statement(s) is/are true?

- a) If an LTI system is causal, it is stable
- b) A discrete time LTI system is causal if and only if its response to a step input $u[n]$ is 0 for $n < 0$
- c) If a discrete time LTI system has an impulse response $h[n]$ of finite duration the system is stable
- d) If the impulse response $0 < |h[n]| < 1$ for all n , then the LTI system is stable.

rule (output should be bounded for bounded input) but in option (D) range of n is not defined, so it is not necessarily to be stable.

Solution:

- 1) A system is said to be causal if its output at any given time depends only on past and present inputs, not future inputs. Mathematically, a system is causal if its impulse response is zero for negative time.
On the other hand, a system is considered stable if its output remains bounded for bounded inputs.
So, it is not always necessary for an LTI system if it is causal, then is stable.
- 2) In discrete-time signal processing, a system is considered causal if the output at any time depends only on the current and past inputs, not future inputs. This means that the response of the system to a step input (a signal that is zero for negative time indices and unity for non-negative time indices) should also be zero for negative time indices if the system is causal. Conversely, if the response to a step input is non-zero for negative time indices, it implies that the system is anticipating future inputs, which violates the causality principle.
So, a discrete-time LTI system is causal if and only if its response to a step input $u[n]$ is 0 for $n < 0$.
- 3) system is said to be stable if it follows BIBO rule (output should be bounded for bounded input) but in option (C) output of $h[n]$ is not defined, so it not necessarily to be stable.
- 4) system is said to be stable if it follows BIBO