

Medium

Deputy Executive Engineer (Electrician) 2026

Sports Authority of Gujarat / Assistant Engineer (Electrical)

Regarding the concepts of causality and stability in continuous-time systems, consider the following statements: 1. A causal system produces output that depends only

A

1 and 2 only

B

2 and 3 only

C

1, 2 and 4 only

Correct

D

All of the above

Correct Answer: C

Full Detailed Explanation

Correct Answer: C - 1, 2 and 4 only

Quick Concept Explanation The Laplace transform must be considered together with its region of convergence. For a rational LTI system, BIBO stability requires the ROC to include the $j\omega$ axis; causality imposes a right-sided ROC for a causal rational system. Key relation: $X(s) = \int_0^\infty x(t)e^{-st}dt$; stability $\Rightarrow j\omega$ axis lies in ROC.

Exam focus: Transform expression + ROC identifies the time signal. Common trap: Never place a pole inside the ROC.

Statement-wise Verification

Statement 1 - Correct. A causal system produces output that depends only on present and past input values, not future inputs. Causality imposes a right-sided ROC for a causal rational system.

Statement 2 - Correct. A system is said to be BIBO stable if every bounded input produces a bounded output. For a rational LTI system, BIBO stability requires the ROC to include the $j\omega$ axis.

Statement 3 - Incorrect. All causal systems are inherently stable due to their dependence on past inputs only. Causality and stability are independent properties; a causal system can be unstable.

Statement 4 - Correct. For an LTI system, inclusion of the imaginary axis in the ROC of its Laplace transform implies stability. For a rational LTI system, BIBO stability requires the ROC to include the $j\omega$ axis.

Core Concept The Laplace transform must be considered together with its region of convergence. The ROC excludes