

Easy

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Consider the following statements regarding Second Order Circuits: 1. A second-order circuit contains two energy storage elements such as inductors and capacitors.

A

1, 2 and 3 only

Correct

B

1 and 4 only

C

2 and 3 only

D

All of the above

Correct Answer: A

Full Detailed Explanation

Correct Answer: A - 1, 2 and 3 only Quick Concept Explanation Second-order dynamics are governed by two independent energy-storage states and are described by natural frequency and damping ratio. An underdamped response oscillates with exponentially decaying amplitude, critical damping gives the fastest non-oscillatory response, and overdamping gives a slower non-oscillatory response. Key relation: Characteristic form: $s^2 + 2\zeta\omega_n s + \omega_n^2 = 0$. Exam focus:

$\zeta < 1$ underdamped, $\zeta = 1$ critical, $\zeta > 1$ overdamped. Common trap: Overdamped responses do not sustain oscillations. Statement-wise Verification Statement 1 - Correct. A second-order circuit contains two energy storage elements such as inductors and capacitors. Second-order dynamics are governed by two independent energy-storage states and are described by natural frequency and damping ratio. Statement 2 - Correct. The transient response depends on damping factor which determines underdamped, overdamped or critically damped behavior. An underdamped response oscillates with exponentially decaying amplitude, critical damping gives the fastest non-oscillatory response, and overdamping gives a slower non-oscillatory response. Statement 3 - Correct. In underdamped case, the response exhibits oscillatory behavior with decaying amplitude. An underdamped response oscillates with exponentially decaying amplitude, critical