

Medium

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Gujarat Public Service Commission / Assistant Engineer (Electrical)

Consider the following statements regarding Second Order Systems: 1. Damping ratio determines the nature of system response such as overdamped, underdamped, or

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:

<1 underdamped, $\zeta=1$ critical, $\zeta>1$ overdamped. Common trap: Overdamped responses do not sustain oscillations. Statement-wise Verification Statement 1 - Correct. Damping ratio determines the nature of system response such as overdamped, underdamped, or critically damped. 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 2 - Correct. Underdamped systems show oscillatory response with decaying amplitude. 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. Critically damped system has fastest response without oscillations. An underdamped response oscillates with exponentially decaying amplitude, critical damping gives