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MJC-Physics, Sem II
Unit-1, Paper-II

## Sharpness of resonance in basic oscillation →

Sharpness of resonance is defined by the quality factor (Q-factor), which quantifies decays in an oscillating system (damping) or define how sensitively a resonant system responds to a specific driving frequency near its natural frequency.

High Sharpness → Characterized by a tall, narrow resonance peak. The system responds only to a very narrow band of frequencies, indicating low damping and slow energy loss.

Low quality factor (Low sharpness) →:
. Characterized by a short, broad resonance peak. The system responds to a wider range of frequencies. Indicating rapid energy loss and high damping.

Relationship to damping → The sharpness of resonance is directly related to the damping coefficient. As damping (fear example is friction, resistance, etc) increases, the sharpness of the resonance decreases. The sharpness is quantified by the quality factor (Q) on mathematically

$$Q = \frac{\omega_0}{\Delta\omega} = \frac{\omega_0}{\omega_2 - \omega_1}$$

Where $\omega_0$ is resonant angular frequency. and $\Delta\omega (\omega_2 - \omega_1)$ is Bandwidth (the difference between the two frequencies at which the power drops to half of its maximum value) A higher Q value means a smaller bandwidth ($2\Delta\omega$) and consequently a sharp resonance. Examples of sharp resonance -

Radio tuning — A high Q circuit allows a radio to select one station (one frequency) while ignoring anothers, producing a 'sharp' resonance. etc.