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ASSIGNMENT #	**02**
SUBMITTED TO	**Engr. KHURSHID ALAM**
SUBJECT	**EARTHQUAKE**
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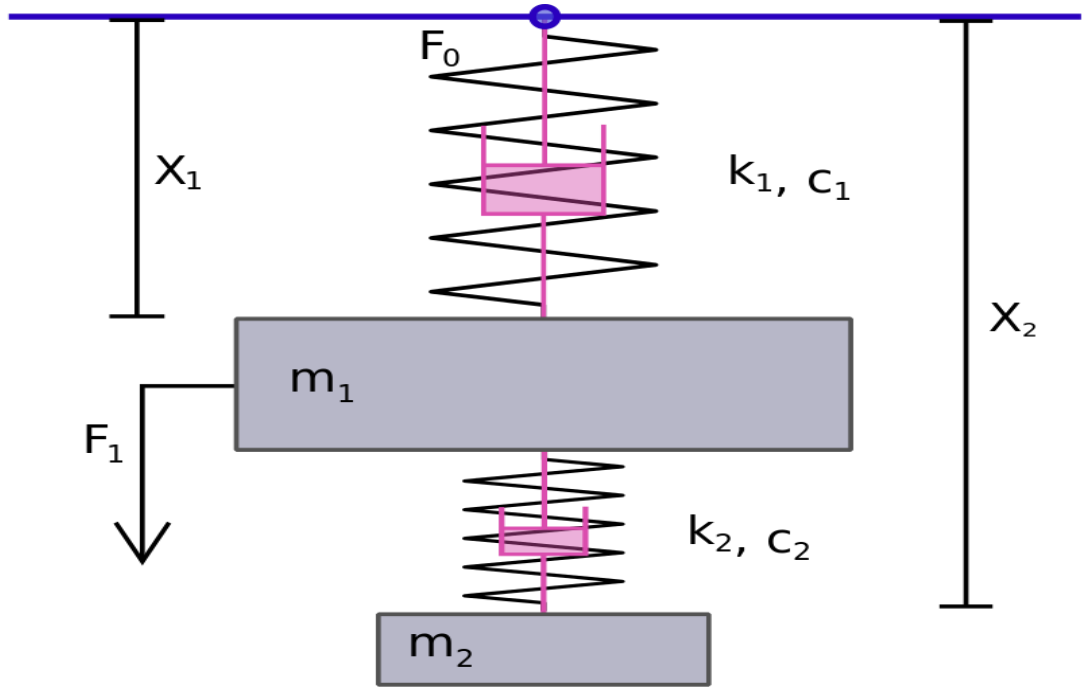
QUESTION # 01:

Tuned Mass Damper:

A **tuned mass damper** (**TMD**), also known as a **harmonic absorber** or **seismic damper**, is a device mounted in structures to reduce the amplitude of mechanical vibrations. Their application can prevent discomfort, damage, or outright structural failure. They are frequently used in power transmission, automobiles, and buildings

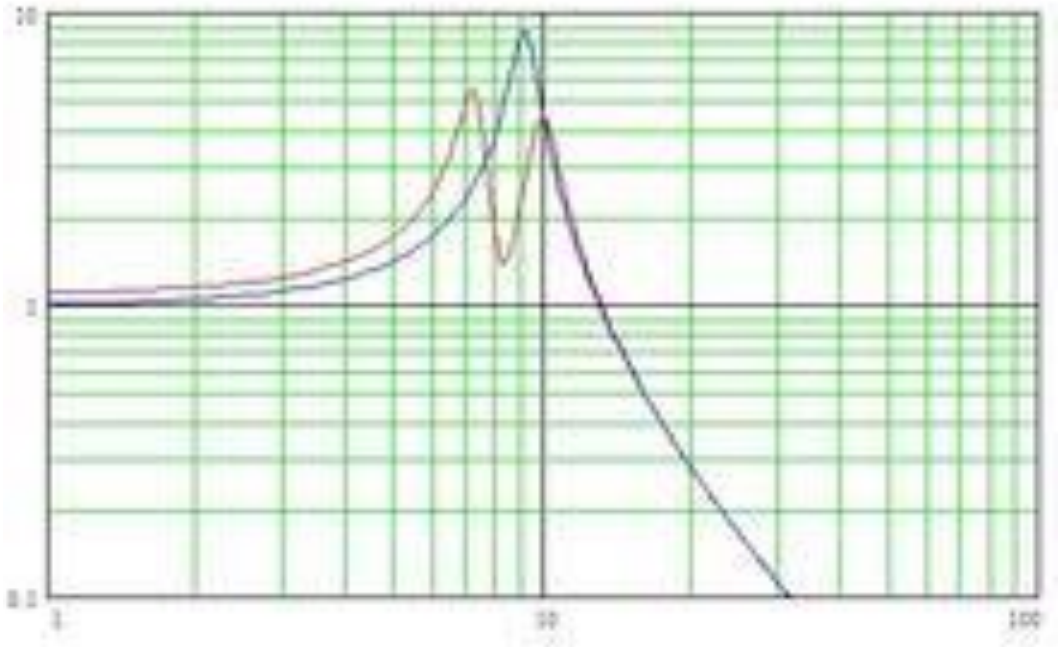
Principle:

Tuned mass dampers stabilize against violent motion caused by harmonic vibration. A tuned damper reduces the vibration of a system with a comparatively lightweight component so that the worst-case vibrations are less intense. Roughly speaking, practical systems are tuned to either move the main mode away from a troubling excitation frequency, or to add damping to a resonance that is difficult or expensive to damp directly. An example of the latter is a crankshaft torsional damper. Mass dampers are frequently implemented with a frictional or hydraulic component that turns mechanical kinetic energy into heat, like an automotive shock absorber.



The graph shows the effect of a tuned mass damper on a simple spring–mass–damper system, excited by vibrations with an amplitude of one unit of force applied to the main mass, m_1. An important measure of performance is the ratio of the force on the motor mounts to the force vibrating the motor, F_0/F_1. This assumes that the system is linear, so if the force on the motor were to double, so would the force on the motor mounts. The blue line represents the baseline system, with a maximum response of 9 units of force at around 9 units of frequency. The red line shows the effect of adding a tuned mass of 10% of the baseline mass. It has a maximum response of 5.5, at a frequency of 7. As a side effect, it also has a second normal mode and will vibrate somewhat more than the baseline system at frequencies below about 6 and above about 10.
The heights of the two peaks can be adjusted by changing the stiffness of the spring in the tuned mass damper. Changing the damping also changes the height of the peaks, in a complex fashion. The split between the two peaks can be changed
by altering the mass of the damper (m_2)

Response of the system excited by one unit of force, with (red) and without (blue) the 10% tuned mass. The peak response is reduced from 9 units down to 5.5 units. While the maximum response force is reduced, there are some operating frequencies for which the response force is increased



QUESTION # 02:

Advantages of base isolation:

- Structural damages is restricted when the structure is built on a suitable seismic isolating system.

- Base isolation allows for a reduction in structural elements of the building with less ductile detailing needed.

- Widely held misconception that seismic isolation is expensive.

- Damage to indoor and services and facilities would be of little concern which would normally affect gas, water or sewages leakages for unfortified structures. the base isolation will protect the structure by preventing plastic deformation of structural elements, because the superstructure demonstrates elastic behavior during initial and following excitation of the base.

- Base isolation can be retrofitted to suitable existing structures but too many variables to give meaningful indication of cost.

- Crawl spaces or basements can have multiple benefits e.g. in siting services, additional income from a car park flexibility for future development.

- Protection of the integrity of the internal structures e.g. stairs internal walls, and partitions.

- Building is safer for occupants and contents are protected.

- Continuity of operations is much more likely.

- Building can remain serviceable throughout construction.

- Does not involve major intrusion upon existing superstructures.

Disadvantages of Base Isolation:

- Cannot be applied partially to structure unlike others retrofitting.
- Challenging to implement in an efficient manner.
- Allowance for building displacements.
- Inefficient for high rise building.
- Not suitable for building rested on soft soil.
- Coupled foundation allow motion of some modes of the structure to include a participating soil mass which increase inertia for these modes and would also allow energy to radiate back into the soil. A base isolation is decoupled from the soil by the isolators. The lower supports stiffness of the isolators makes the building more susceptible to wind induced motion.