CE 6701 - STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

UNIT - 1 TWO MARKS

1. Differentiate between static and dynamic loads (Nov 2011).

S.No.	Static Load	Dynamic Load
1	Load is constant with respect to time	Load varies with time
2.	Response is one which is displacement	Three responses viz. displacement, velocity and acceleration
3.	Only one solution	Infinite number of solutions
4.	Solved using equations of static equilibrium	Both loads and inertia forces which oppose acceleration has to be taken into account. Total response equals static and inertial responses.

2. What are the various types of dynamic loads? (Nov 2013)

A load whose magnitude, direction and position vary with time is called as a dynamic load. Egs. Wind load, Earthquake load, bomb blast etc.

3. What do you mean by response of the system?

It is the magnitude and distribution of the resulting forces and displacement in a system due to vibration.

4. Define degree of freedom. (Nov 2013, May 2014,May2018)

It is the number of independent coordinates required to specify the position or geometry of mass point at any instant of time during its vibration.

5. Differentiate between free and forced vibration. (Nov 2013, May 2013)

The vibration which persists in a structure after the force causing the motion is removed is known as free vibration.

The vibration which is maintained in a structure by steady periodic force acting on the structure is known as forced vibration.

6. State D'Alemberts Principle.
(May 2013, Nov 2013, May 2014, Nov 2016, April 2017, Nov 2017, Apr 2018)

It states that, " a system is in a state of dynamic equilibrium by adding external forces, an imaginary force called as Inertial force."

7. Define damping. (Nov 2014)

It is a phenomenon in which the energy of the system is gradually reduced or the amplitude of vibration goes on decreasing and finally the vibration of the system is completely eliminated and the system is brought to rest.

8. Explain critical damping. (Nov 2012)

It is defined as the minimum amount of damping for which the system will not vibrate when disturbed initially but will return to the equilibrium position.

9. Compare over damping and under damping. (Nov 2011)

From the characteristic equation of motion with damping the radical term is
$(c^2 / m^2) - (4k /m)$.

If the value of radical term is positive or greater than zero then the system is **over damped** system and the roots of the equation are purely real and distinct.

If the value of the radical term is negative or less than zero then the system is **under damped** system and the roots of the equation are complex conjugates.

10. **Define viscous damping. (nov 2011)**

When a system is made to vibrate in a surrounding viscous medium that is under the control of highly viscous fluid, the damping is called viscous damping.

11. **What is dynamic load factor? (Nov 2011)**

It is defined as the ratio of dynamic displacement at any time to the displacement produced by static application of the load. It is also called **as Magnification factor or Response ratio or Deformation response factor.**

12. **Explain frequency ratio. (nov 2012)**

It is defined as the ratio of frequency of applied force to the natural frequency of the system. It is also called as **frequency cut**.

13. **What is an impulsive force?(Nov 2011)**

A very large magnitude of force acting for a very short period of time is called as Impulsive force or Shock load.

14. **Define Transmissibility.**

It is the ratio of the maximum amplitude of motion of the oscillator to the amplitude of support motion which is called as Transmissibility of Support motion.

15. **Explain resonance.**

When the frequency of the applied load matches or equals with the undamped natural frequency of the system, the system is said to be resonant. This phenomenon is called resonance.

16. **What are the types of vibration? (Nov 2016, Apr 2017)**

Free vibration, forced vibration, Damped vibration, undamped vibration, Linear vibration, nonlinear vibration, Deterministic vibration, Non deterministic vibration, Transverse vibration, Longitudinal vibration and Torsional vibration.

17. **What are the types of damping?**

Viscous damping, Coulomb damping, Structural damping, Active or Negative damping and Passive damping.

18. **What do you mean by Natural period and Natural Frequency of a system? (Nov 2014)**

Natural Period: It is the time required to complete one cycle of free vibration.

Natural Frequency: It is the frequency corresponding to the free vibration. It is expressed in no. of cycles per unit time (Hertz or rad/sec).

$\omega_n = \sqrt{(k/m)}$, where ω_n = natural frequency in rad/sec, k = stiffness in N/mm, m= mass in kg.

19. **Give the equation for equivalent stiffeness for parallel and series system of springs. (Nov 2014)**

Springs in parallel:

Equivalent stiffness of the system = $K_e = K_1 + K_2 + \ldots + K_n$

Springs in series:

Equivalent stiffness of the system = $(1/K_e) = (1/K_1) + (1/K_2) + \ldots + (1/K_n)$

20. **Write the expression for Logarithmic Decrement. (Nov 2017)**

$\delta = \ln (x_1 / x_2)$, where x_1, x_2 are two consecutive displacements.

21. **Write the Duhamel Integral for displacement under impulsive loading.**

$$X(t) = (1/m \omega_n) \int F(\tau) \sin \omega_n (t-\tau) \, d\tau$$