Test paper 6 Dynamics of Ocean Structures

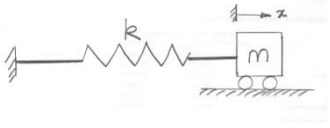
Maximum marks: 25 Time 50 minutes

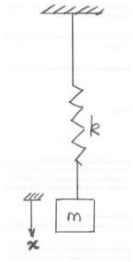
Section A: Objective questions (each question carries one mark)

1. A continuous structure has _____ number of degrees-of-freedom
2. In structural dynamics, mass element, m represents _____ and _____ characteristics of the structure Similar to the above, _____ represents elastic restoring force and _____ capacity of the structure
3. A sketch of the body, isolated from all other bodies, in which all forces external to the body are shown is called as _____
4. An alternate approach which states that the system may be set in a state of dynamic equilibrium is called as _____
5. How are frequency and time period related? State their units in SI system
6. Degree-of-freedom of a system is the number of independent coordinates necessary to describe its position. True or false. If false, re-write the correct statement
7. It is observed experimentally that amplitude of free vibration of certain structure, modeled as single degree-of-freedom decreases from 1 to 0.4 in 10 cycles. What is the % of critical damping?
8. The simplest form of periodic motion is _____
9. What is dynamic degrees-of-freedom?
10. What are the essential characteristics of a dynamic loading?

Section B: Give brief answers (each question carries two marks)

1. It is not always possible to obtain rigorous mathematical solutions for engineering problems. Should you agree to this statement, then which provides a reasonable link between the real physical system and mathematically feasible solution?
2. *"In single degree-of-freedom, damping element represents only dissipation of energy. Such pure elements do not exist in physical world"*. Based on the above statement, define what is a mathematical model?
3. Do both the figures shown below represent mathematical models that are dynamically equivalent? Explain your answer briefly





4. In a single degree-of-freedom model, spring is considered as a linear spring. IN other words, force-displacement properties of the system are taken as linear. Is it a hypothetical situation compared to the real dynamic behavior of structures? Explain
5. Find time period of the structure shown below (Fig. 1). Cross section of the column is circular of 50mm diameter, made of steel. Take E_{st} as $2x10^5$ N/mm^2, mass as 100kg, length of the column as 2m.

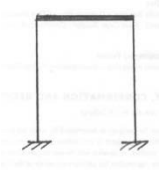


Fig. 1 (for problem 5)

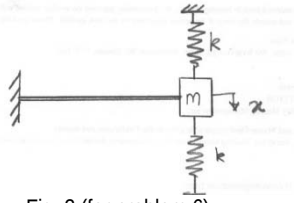


Fig. 2 (for problem 6)

6. A cantilever beam is shown in figure has a lumped mass of 10kg at its tip. Length of the beam is 1.5m and stiffness of springs attached to the mass is 100N/m. For initial displacement of 25mm and initial velocity of 0.5m/s, find the displacement and velocity of the system after 1s. Take E_{st} as $2x10^5$N/mm^2. Neglect the self weight of the beam. Beam is made of a steel flat of size 6mm x 100mm

7. A vibrating system having mass of 4.5kg and stiffness of 3500N/m is viscously damped so that ratio of two consecutive peaks is reduced from 1.0 to 0.85. Determine natural frequency, logarithmic decrement, damping ratio, damping coefficient and damped natural frequency

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