Code No: D2002 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH II - SEMESTER EXAMINATIONS, APRIL/MAY 2012
STRUCTURAL DYNAMICS
(STRUCTURAL ENGINEERING)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks
- - -

1.a) Define Logarithmic Decrement. Sketch and show how Logarithmic decrement varies with damping ratio.

b) A rigid disc of mass m is mounted at the end of a flexible shaft. As shown in fig.1. Neglecting the weight of the shaft and neglecting damping derive the equation for free torsional vibration of the disc. The modulus of rigidity of the shaft is G.

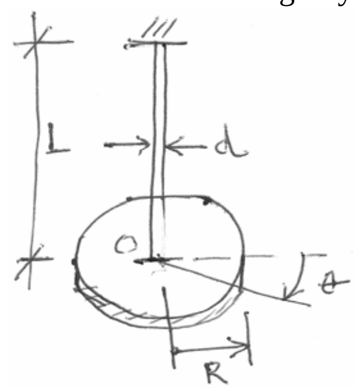

Fig 1

2.a) Describe how the equation of motion can be set up using Newton's second law of motion for the system shown in Fig.2: (Assume the stiffness of the system is F_s)

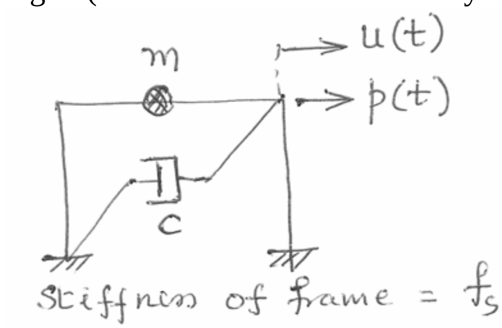

Fig 2

b) Indicate how the equation is modified for earthquake horizontal ground acceleration u_g.

c) Starting from the basic definition of stiffness, determine the effective stiffness k of the spring mass system shown in Fig.3

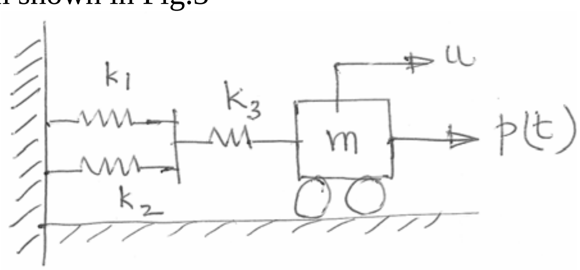

Fig 3

3.a) Indicate how Duhamel integral can be used to find the response of system shown in Fig.4a for Unit impulse.

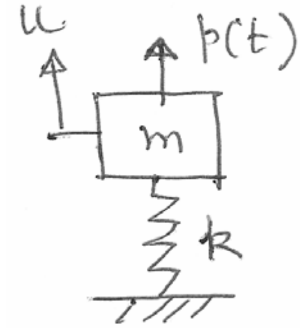

Fig 4a

b) Hence show how the response can be had for the rectangular pulse shown in Fig.4b.

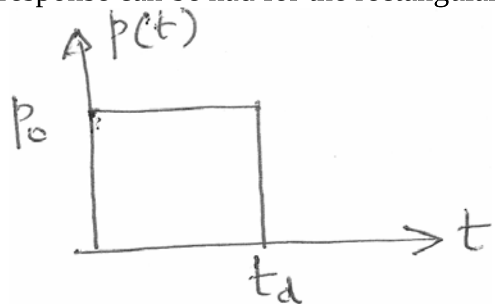

Fig 4b

4. Determine the natural frequencies and modes of vibration for the system shown in Fig.5 Normalize the modes to have unit vertical deflection at the free end.

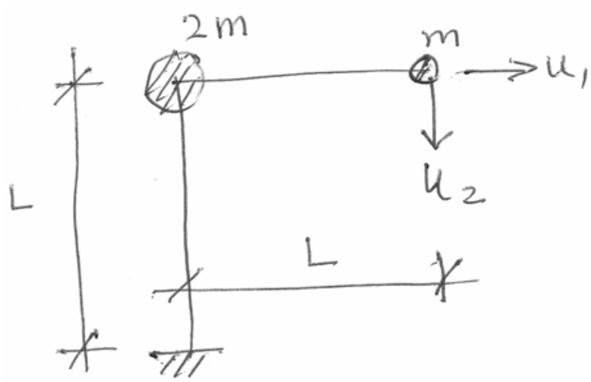

Fig 5

5. Determine the equation of motion of the beam shown in Fig.6a expressed in terms of Displacements u_1 and u_2 shown in Fig.6b. Hence deduce natural frequencies and mode shapes.

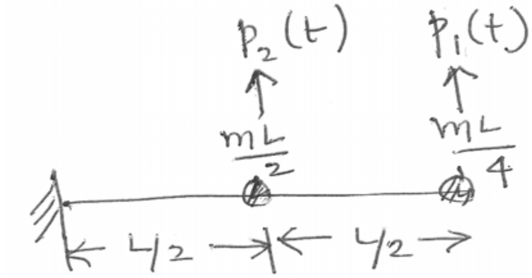

Fig 6a

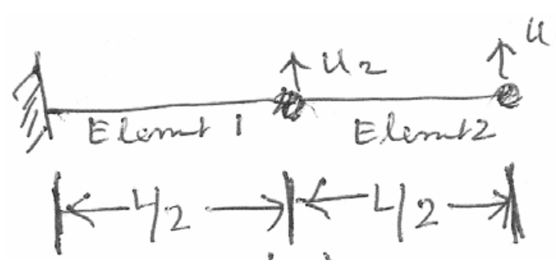

Fig 6b

6. Describe the dynamic analysis procedure as per IS 1893:2002 for a high rise building with 4 stories. Indicate how the mass is lumped and the seismic force is distributed along the height. Distinguish between CQC and SRSS procedures given in the code.

7. Find the first three vibration frequencies and modes of an uniform beam clamped at one end and free at the other. Sketch the mode shapes.

8. Write Short Notes on:
   a. Hamilton Principle
   b. Holzer method
   c. Response spectrum
   d. Uncoupling of equations of motion.

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