COURSE CODE (3 CREDITS): 11M1WCE112   MAX. MARKS: 35

COURSE NAME: Structural Dynamics

COURSE INSTRUCTORS: Dr. Tanmay Gupta   MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. A delicate instrument weighing 100 lb is to be mounted on a rubber pad to the floor of a test laboratory where the vertical acceleration is 0.1g at a frequency of 10 cycles per second. It has been determined experimentally that the ratio of the stiffness k, to the damping coefficient c, is equal to 100 (1/sec) for the type of rubber pad material used in the isolation. What is the stiffness of the isolation required to reduce to 0.01g the acceleration transmitted to the instrument?   [7]

Q.2 For the figure shown below, the steel frame supports a rotating machine that exerts a horizontal force at girder level F(t) = 200 sin 5.3t lb. Assuming 5% critical damping and girder to be rigid, determine

(a) the steady state amplitude of vibration

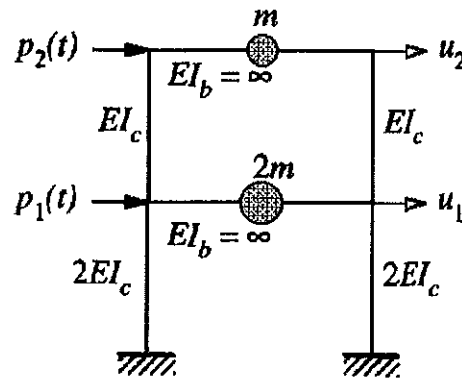(b) the maximum dynamic stress in the columns   [8]
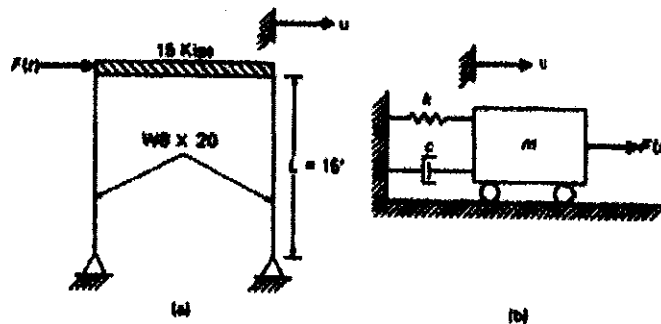
Q.3 Write a short note on the following:

1. Force Transmissibility

2. Base isolation   [6]

Q.4 For the system shown in Figure below, formulate the equation of motion governing the undamped free vibration [6]

Q.5 For a Single degree of freedom structure having known material properties, (k,M,c), write the procedure to determine its response U(t) when it is subjected to an external loading p(t) with the help of central difference method. Consider the time step as Δt. You may use all general notations.

[8]