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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- Oct 2017

B.Tech VII / M.Tech I Semester

COURSE CODE: 11M1WCE112 MAX. MARKS:15

COURSE NAME: STRUCTURAL DYNAMICS

COURSE CREDITS: 3 MAX. TIME: One Hr

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

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1. A block of mass $\boldsymbol{M = 0.20\ kg}$ is placed between two identical springs, whose combined stiffness is $\boldsymbol{20\ N/m}$. The mass can slide without friction over the horizontal bar AB (see **Fig # 1**). The whole speed rotates with a constant angular velocity $\boldsymbol{\omega = 4.4\ rad/s}$ about a vertical axis passing through the middle of the bar AB. If the block M is slightly displaced from its original position shown in the figure, the block will start to oscillate.
   - **a.** Write down the equation of motion of the block M for small oscillation.
   - **b.** Find the period of oscillation.
   - **c.** At what values of $\boldsymbol{\omega}$ will there be no oscillation of the block? **[6 Marks]**

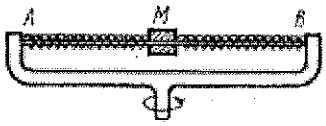

Fig # 1

2. A projectile of mass $m = 10\ kg$ travelling with a velocity $v = 50\ m/s$ strikes and becomes embedded in a massless board supported by a massless spring of stiffness $k = 6.4 \times 10^4\ N/m$ in a parallel with a dashpot with coefficient of viscous damping $c = 400\ N.m/s$. Determine the time required for the board to reach the maximum displacement and the value of the maximum displacement. **[4 Marks]**

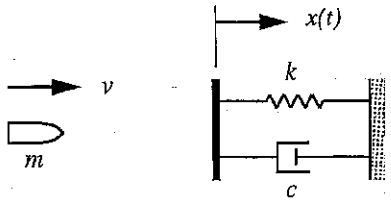

Fig # 2

CE-18, BTMT

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3. Find the steady-state response of the mass-damper-spring system modeled by the following ODE: **[5 Marks]**

$$\ddot{x} + 4\dot{x} + 3 = \cos(t) + \frac{1}{3}\cos(3t)$$