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10AE65

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Theory of Vibrations

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

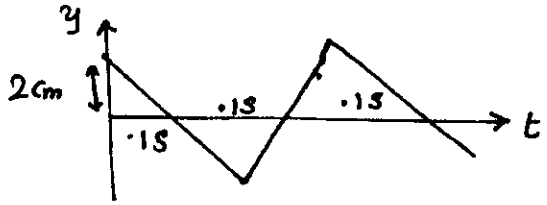
PART – A

1 a. Define the following terms
i) Simple Harmonic motion ii) Damping iii) Degrees of freedom iv) Natural frequency **(08 Marks)**

b. An oscillating system with natural frequency of 3.98Hz starts with critical displacement of 10mm and velocity 125mm/sec. Calculate all the vibratory parameter. **(04 Marks)**

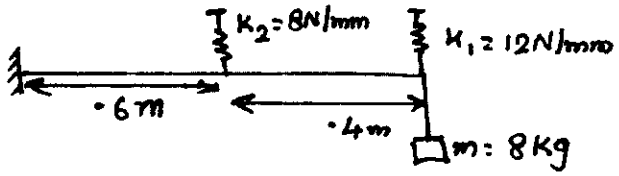
c. Find the harmonic series of Periodic motion shown. **(08 Marks)**

Fig. Q1(c)



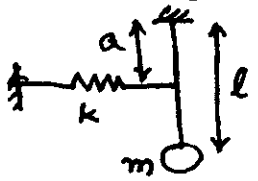
2 a. Find the natural frequency of the system. Shown in Fig. Q2 (a) **(10 Marks)**

Fig. Q2(a)



b. Find the natural frequency for system shown in Fig. Q2(b). **(10 Marks)**

Fig. Q2(b)



3 a. Define logarithmic decrement and show $\delta = \frac{2\pi\xi}{\sqrt{1-\xi^2}}$ with usual notation. **(08 Marks)**

b. A gun barrel of mass 600kg has a recoil spring of stiffness 294,000N/m. If the barrel recoils 1.3m on firing, determine
i) Initial velocity of barrel
ii) Critical damping co-efficient of the dash pot engaged at the end of recoil stroke.
iii) Equation of motion of the barrel **(07 Marks)**

c. A spring mass dash pot system is given an initial velocity of magnitude w_n from equilibrium position. Find equation of motion when $\xi = 2$. **(05 Marks)**

4 a. What is Dynamic Magnification factor? Derive an expression for it and discuss its variation with frequency ratio and damping ratio. **(10 Marks)**

b. Discuss the response of a single D.O.F system under a forcing function F_0e^{iwt}. **(05 Marks)**

c. Determine the power required to vibrate a spring mass damper with amplitude of 15mm at a frequency 100Hz. The system has a damping factor of 0.05 and damped natural frequency of 22Hz. The mass of system is 0.5kg. **(05 Marks)**

PART – B

5 a. Derive an expression for critical speed of shaft. Explain the situation through which shaft deformation goes, when shaft speed is increased gradually to speed much above critical speed from rest. **(12 Marks)**

b. Simply supported shafts at its 2 ends carry a mass at its centre with an eccentricity of 0.4mm. Determine the critical speed of shaft and permissible range of speed, if maximum stress permitted for shaft material is 70Mega Pascals. **(08 Marks)**

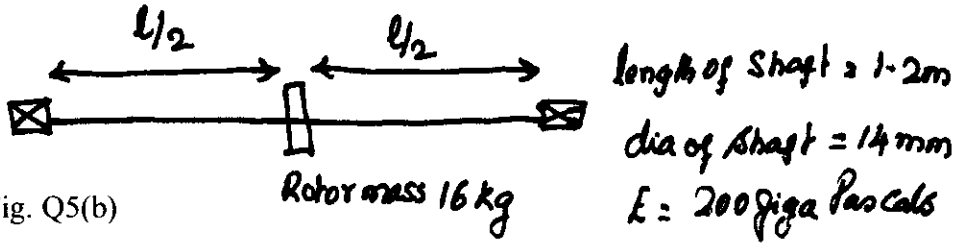


Fig. Q5(b)

6 For the system shown, If mass m_1 is displaced 20mm from its static equilibrium position, determine resulting displacement equation

Given $m_1 = m_2 = m$

$k_1 = k_2 = k_3 = k$ **(20 Marks)**

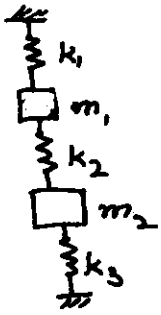


Fig. Q6

7 a. A uniform string of length ℓ stretched with initial large tension between two supports is displaced laterally through a distance a_0 at the centre and released. Find the equation of motion. **(12 Marks)**

b. Form the differential equation for string, mentioning the assumptions made. **(08 Marks)**

8 a. Using Stodola method, find fundamental frequency and mode for the system shown in Fig.Q8 (a) **(12 Marks)**

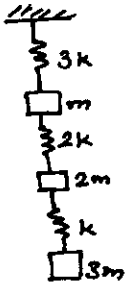


Fig. Q8 (a)

b. A shaft 180mm dia is supported at 2.5m apart. It carries three discs of weight 2500N, 500N and 2000N at 0.6m, 1.5m and 2m from left end. Assume shaft weight to be 1900N/m and E = 200GPa. Determine the natural frequency of transverse vibration. **(08 Marks)**

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