

MECH 364: MECHANICAL VIBRATIONS

MIDTERM EXAMINATION 3

Time: 45 minutes

23rd March 2011

Maximum Available Mark: 20

PLEASE READ THE QUESTION CAREFULLY.

Q1.

- a) Explain in one sentence the working principle involved in the design of an isolation system? **(3 marks)**
- b) An internal combustion engine has a rotating unbalance of $m_ue = 1$ kg-m and operates between 800 and 2000 rpm. Due to the unbalance a harmonic force of amplitude $F = m_ue\omega^2$ is exerted. Find the stiffness of the isolator necessary to reduce the transmitted force, F_t , to the floor to 4000N over the operating speed range of the engine. Assume that the damping ratio of the isolator is $\zeta = 0.08$, and the mass of the engine is 200 kg. Useful formulae: $TR = \frac{F_t}{F} = \frac{\sqrt{1+(2\zeta r)^2}}{\sqrt{(1-r^2)^2+(2\zeta r)^2}}$, where $r = \frac{\omega}{\omega_n}$ and $\zeta = \frac{c}{2m\omega_n}$. **(14 marks)**
- b) Discuss in five sentences or less, the advantages and drawbacks of using a damper in isolators. **(3 marks)**
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ALL THE BEST!