



DEPARTMENT OF CIVIL ENGINEERING

**MINOR II :CVL864 STRUCTURAL HEALTH MONITORING
(2018-19)**

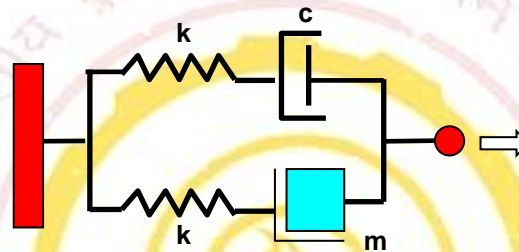
Time allowed: 1hour
Venue : LH 410

Date : 26 March 2019
Max marks : 15

NOTE: (a) This question paper contains one page only. (b) All questions are compulsory. (c) **Assume any data which you deem is necessary but not supplied.** (d) Draw neat and clear sketches wherever required.

Question 1.

Derive an expression for the mechanical impedance of the system shown below in format $Z = x+yj$



(5 marks)

Question 2.

Based on Liang's 1D impedance formulation given below, explain the reasons behind observations (a) and (b):

$$\bar{Y} = 2\omega j \frac{w l}{h} \left[\frac{\bar{\epsilon}_{33}^T}{Z + Z_a} + \left(\frac{Z_a}{Z + Z_a} \right) d_{31}^2 \bar{Y}^E \left(\frac{\tan kl}{kl} \right) - d_{31}^2 \bar{Y}^E \right]$$

- (a) Why do the real and imaginary components show an increasing trend with frequency?
- (b) The magnitude of the imaginary part is very high as compared to the real part

(2+3= 5 marks)

Question 3.

If the damping ratio of a material is 10%, find out:

- (a) Corresponding mechanical loss factor
- (b) Rayleigh damping coefficients corresponding to frequency range 100-150 kHz

(1+4= 5 marks)