



MAJOR :CVL864 STRUCTURAL HEALTH MONITORING
(2024-25)

Time allowed: 2 hours
Venue : LH 421

Date : 08 May 2025
Max marks : 40

NOTE: (a) This question paper contains two pages 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. (e) Provide full explanations for securing full marks

Question 1

- (a) Explain why the imaginary component of admittance (B) in the EMI technique does not display structural resonance peaks as effectively as the real component (G)?
- (b) Why the zone of influence of the PZT patch in the EMI technique is localized in nature?
- (c) How would you carry out diagnostics of a PZT patch for EMI technique before relying on the signature?

(2+2+3=7 marks)

Question 2

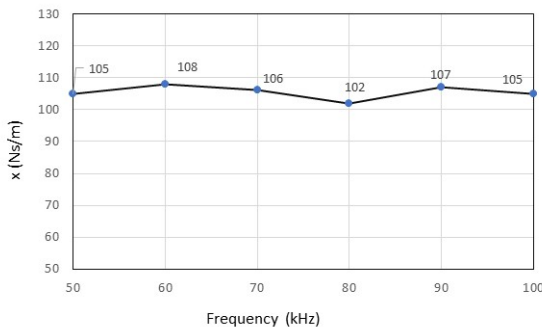
- (a) Derive the expression for the mechanical impedance of a PZT patch. State the assumptions clearly.
- (b) How would you determine the natural frequencies of the PZT patch using the derived relation?

(4+2=6 marks)

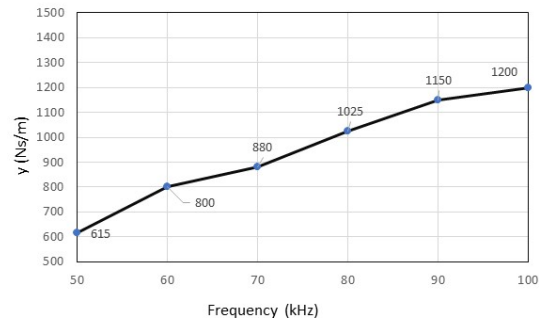
Question 3

Identify the composition of the structural system represented by following plots of “x” and “y” (obtained from signatures of piezo patches bonded on structure) and determine the most representative values of the structural parameters.

(6 marks)



(a)



(b)

(a) x versus frequency (b) y versus frequency

Question 4

Differentiate between low cycle and high cycle fatigue.

(3 marks)

Question 5

Describe the principle of the acoustic emission technique. State the operational requirement of the technique not relevant to all other NDE techniques

(2+3 =5 marks)

Question 6

A piezo patch (10x10x0.25 mm) and an accelerometer are instrumented at the mid-point location of a steel bridge girder 30 m in span and 1.5 m in depth. Due to a passing vehicle, the bridge starts undergoing vibrations. At a particular instant, the piezo patch displays a peak voltage of 6V.

- (a) Determine corresponding strain and the deflection at the mid point of the beam as measured by the piezo patch. The piezo parameter are: relative dielectric permittivity: 1750, d_{31} : 195×10^{-12} C/N, Young's modulus: 6.67×10^{10} N/m².
- (b) Will this strain be the overall strain (static + dynamic)? Provide explanation for your answer
- (c) How would you correlate the outcome of the piezo patch with that of the accelerometer?

(6+2+2 = 10 marks)

Question 7

Define Nyquist frequency and aliasing.

(3 marks)