DEPARTMENT OF CIVIL ENGINEERING

MAJOR :CVL864 STRUCTURAL HEALTH MONITORING
(2018-19)

Time allowed: 2 hours   **Date**   **:** 28 Apr 2019
Venue   **:** LH 410   **Max marks**   **:** 30

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. (e) Provide full explanations for securing full marks

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Question 1.
At what maximum depth below surface is it possible to identify a subsurface flaw using the thermal imaging technique? State the physical reasons for the same.

(04 marks)

Question 2.
Explain how a low-cost version of LCR meter can be set up in the lab using simple and commonly available instruments. Please also explain the circuit diagram involved in the measurement using this low-cost set up with all assumptions.

(04 marks)

Question 3.
What is Wohler curve and what is fatigue limit? How the EMI technique can be used to estimate the residual stiffness and residual life of a component undergoing fatigue.

(04 marks)

Question 4.
Draw the typical shape of curve between non-dimensional stiffness loss and cycle ratio for a steel or RC member undergoing fatigue. Identify three major regions and define characteristic of each.

(03 marks)

Question 5.
Determine the first three natural frequencies of a piezo patch 5x5x0.2 mm size under "free-free" conditions. Assume Young's modulus as 6.67×10^{10} N/m^2 and density as 7600 kg/m^3.

(03 marks)

Question 6.
Quantitatively define the term d_{31} using the equations for direct as well as converse piezoelectric effects

(04 marks)

Question 7.
A stainless steel metal wire used as VWSG on a structure has a length of 10 cm. If the change in frequency is registered as 25 Hz (increase), compute the true strain induced in the structure.

(03 marks)

Question 8.
If you are provided with a 5m long steel beam instrumented with piezo patches at an interval of 50 cm, which technique would you choose for locating the damaged region and why? Assume that all necessary instruments are available but you don't have any prior experience of using them practically, you only have read about each technique in depth. You are going to use any technique for first time.

(03 marks)

Question 9.
State any four assumptions in Liang's 1D impedance model.

(02 marks)