

DEPARTMENT OF CIVIL ENGINEERING



MINOR I :CEL836 STRUCTURAL HEALTH MONITORING (2014-15)

Time allowed: 1hour
Venue : VI 401

Date : 14 February 2015
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.

A metal wire strain gauge has a length of 10cm and a diameter of 3mm. If the change in frequency is registered as 20 Hz (increase), compute the strain induced in the structure. The prestrain induced in the wire by the manufacturer was 1500 microstrain. Density of steel = 7800 kg/m^3 and Young's modulus of steel = 200 GPa.

(5 marks)

Question 2.

List any three major observations made by Farrar et al. in their damage detection experiment involving a real bridge

(3 marks)

Question 3.

A PZT patch of size $10 \times 10 \times 0.3 \text{ mm}$ is supposed to be employed as a sensor at the mid point of a simply supported steel beam (ISMB 250) of length 5m. If a potential difference of 10V is registered across the PZT patch when hit with a hammer at the mid point, determine the following:

- The strain occurring at the extreme fibres at the mid point location.
- The corresponding peak deflection at the mid point.

Assume electric permittivity = $2.12 \times 10^{-5} \text{ F/m}$, piezoelectric strain coefficient = $2.10 \times 10^{-10} \text{ m/V}$, Young's modulus of steel = 200 GPa, Young's modulus of PZT patch = $6.67 \times 10^{10} \text{ N/m}^2$.

(7 marks)