

DEPARTMENT OF CIVIL ENGINEERING



MINOR I :CEL864 STRUCTURAL HEALTH MONITORING (2019-20)

Time allowed: 1 hour
Venue : LH 416

Date : 06 February 2020
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.

Define all symbols in following expression:

$$[K] = \{[\Phi]^T\}^{-1} [\Omega][M_p][\Phi]^{-1}$$

Obtain expression for flexibility matrix using above equation as base, assuming mass normalized eigenvectors.

(5 marks)

Question 2.

A vibrating wire strain gauge (VWSG) of length 10 cm is instrumented on a prestressed concrete bridge undergoing both load induced strain as well as temperature fluctuation. At the time of instrumentation of the VWSG, the temperature was 30°C, which jumped to 40°C at the time of measurement. The frequency of the VWSG was observed to increase from the base value of 1000 Hz to 1030 Hz. Determine the true strain undergone by the bridge. Coefficient of thermal expansion of steel and concrete are $7.2 \times 10^{-6} \text{ C}^{-1}$ and $10 \times 10^{-6} \text{ C}^{-1}$ respectively.

(5 marks)

Question 3.

How can the constant d_{31} of a piezo element be measured in laboratory using converse piezoelectric effect?

(2.5 marks)

Question 4.

Explain why accelerometers are considered to be low-bandwidth sensors

(2.5 marks)