



MID-TERM EXAM :CEL864 STRUCTURAL HEALTH MONITORING
(2024-25)

Time allowed: 1 hour
Venue : LH 408

Date : 27 February 2025
Max marks : 20

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 pair of vibrating wire strain gauges (VWSG) of gauge length 125 mm are instrumented on the extreme fibers of a plate girder of a bridge. The plate girder consists of a web of size 1000x10 mm and top and bottom flange plates of size 450x25 mm. In empty bridge condition, both the gauges display a frequency of 1080 Hz, which changed to 1150 Hz (bottom) and 1025 Hz (top) under traffic. During this time, the temperature increased by 13°C on the top of the girder and 4°C on the bottom side. Determine the traffic induced bending moment on the girder. The coefficient of thermal expansion of the vibrating wire is $14 \times 10^{-6}/^{\circ}\text{C}$ and that of the mild steel is $13 \times 10^{-6}/^{\circ}\text{C}$.

(10 marks)

Question 2.

A shaker is applying a force of 200 N amplitude on a bridge at a frequency of 5 Hz. The measured acceleration amplitude is 1 ms^{-2} . Determine the amplitude of the displacement based FRF for that location.

(3 marks)

Question 3.

Describe the damage index method. Why does the method performs best with regard to damage detection in global dynamic techniques

(4 marks)

Question 4.

State two similarities and two differences between the EMI technique and the global dynamic techniques.

(3 marks)