Ref: Ex/Con/T/426B/2017

B. Construction Engineering 4th Year 2nd Semester Examination 2017

STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING

Time: Three Hours

Assume any relevant data not provided

Answer any Four Questions

Full Marks: 100

1 a) Distinguish between Magnitude and Intensity of earthquake and their significance in earthquake resistant design. 6

b) Discuss Response Spectrum method for seismic resistant design 4

c) Distinguish between near field & far field effect of earthquake on structures 9

d) Discuss on favourable structural configuration with respect to better earthquake resisting features. 6

2 a) Derive the equation of motion of a dynamic system based on D' Alembert's principle. 4

b) Derive the free vibration solution of an under-damped SDOF system. Compare the damped natural period with un-damped natural period? 14

c) Discuss Logarithmic Decrement Method for evaluating critical damping ratio. 7

3 Derive the equation for Multi Degree Freedom System (MDOF) and discuss on various modes and corresponding natural frequencies of the system? 13

b) Find the natural frequencies and mode shapes of the following 2DOF system. 12

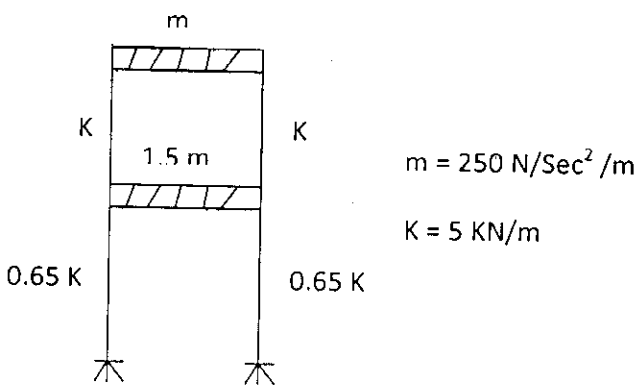

Figure 1

4 a) What do you mean by transient phase with respect to force vibration? What will happen in case of an absolute un-damped system? 4

b) Derive the solution for steady state motion of the SDOF system under Forced Vibration of $M\ddot{x} + C\dot{x}\ Kx = F_0 \text{ Cos } w_f t$. 14

c) Derive Dynamic Load Factor? Derive the expression and evaluate the D.L.F when the tuning factor is 0. 95 and damping ratio is 2%. 7

5 a) Distinguish between Dynamic Analysis and Response Spectrum method with respect to seismic design of structure according to relevant Indian code. 8

b) Calculate the natural period, circular frequency of the cantilever beam spanning 0.5 m. The member is made of mild steel round section of diameter 45 mm and subjected to a load of 22 KN at the free end as shown in Fig.2. Neglect the mass of the beam. 7

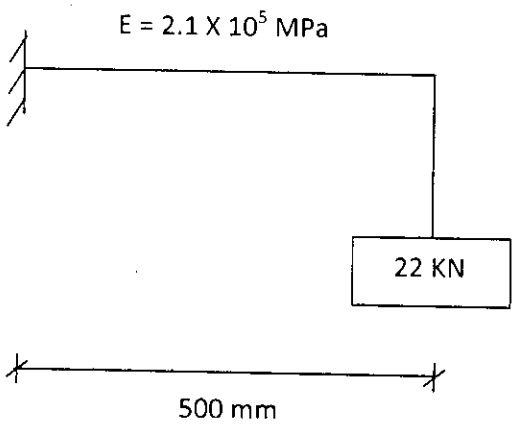

Fig 2

c) Find also the damped natural frequency of the system with the spring at the end if the critical damping ratio (ξ) is 2 % 3

b) If the cantilever is made of square section mild steel of same cross sectional area calculate the change in time period. 4

e) If the same cantilever is made with 45 mm diameter round bar made of Aluminium with $E = 6.9 \text{ X } 10^4$ MPa, $\xi =$ 2.5%, calculate the change in frequency of the beam. 3