Earthquake Engineering: Intro to Structural Dynamics

A two-story one bay frame system is modeled as shear frame model. A modal and linear time history analyses are performed for the frame. The frame has an equivalent floor masses and lateral stiffnesses as documented below. Use a constant modal damping ratio of 4% for the first mode and 7% for the second mode.
The ground motion record is given to you.

m_1=m k_1= 1.5k

m_2=1.5m k_2= k

m= 3ton k= 10000kN/m

The required deliverables:

- Find Natural frequencies and mode shapes of the frame
- Develop an excel file to solve the uncoupled equations of motion using Newmark's algorithm. Document and draw the time history of the second floor's displacement and acceleration

$$\left(\underline{\phi}_n^T \underline{m} \underline{\phi}_n\right) \ddot{q}_n + \left(\underline{\phi}_n^T \underline{c} \underline{\phi}_n\right) \dot{q}_n + \left(\underline{\phi}_n^T \underline{k} \underline{\phi}_n\right) q_n = -\underline{\phi}_n^T \underline{m} \underline{l} \ddot{u}_g$$

Submitted deliverables

1. A brief report:

   Explain in it the steps and equations used to develop the solution and presnet the output

2. One Excel file (with different sheets) documenting your solution