Problem 1: A two degree-of-freedom manipulator is shown in the figure below. Given that the length of each link is $l$; mass of the links are $m_1$ and $m_2$; derive the dynamic model of this two-link robot arm using Lagrange-Euler method. Assume the mass is equally distributed and all the products of inertia are zero, with the pseudo-inertia matrices are:

\[
J_1 = \begin{bmatrix}
\frac{1}{3}m_1l^2 & 0 & 0 & -\frac{1}{2}m_1l \\
0 & 0 & 0 & 0 \\
-\frac{1}{2}m_1l & 0 & 0 & m_1
\end{bmatrix}
\quad
J_2 = \begin{bmatrix}
\frac{1}{3}m_2l^2 & 0 & 0 & -\frac{1}{2}m_2l \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 \\
-\frac{1}{2}m_2l & 0 & 0 & m_2
\end{bmatrix}
\]