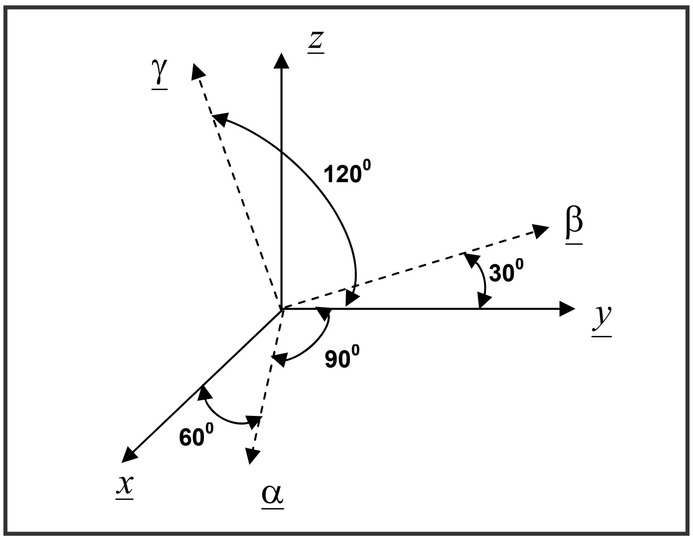
Due date: Thursday, Feb 4, 2016
(Before lecture starts)

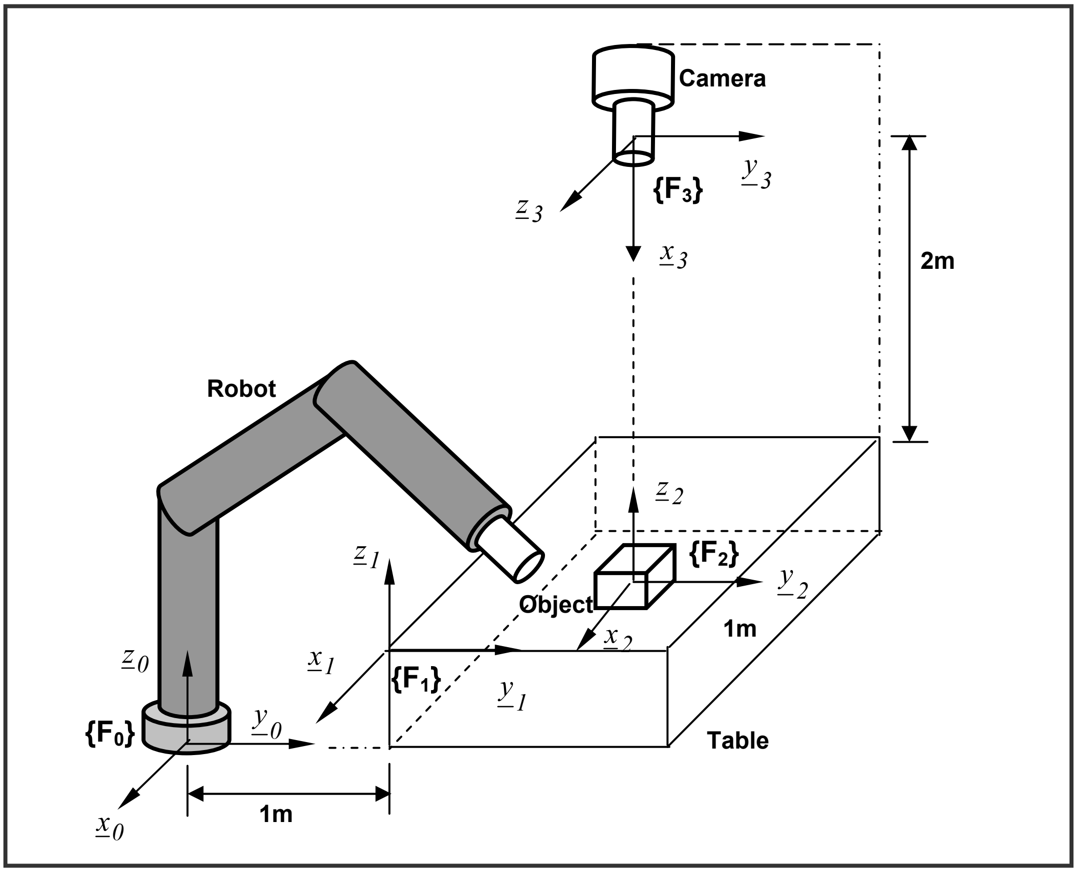
ME4524 – Robotics and Automation

Exercise # 1

1. Determine the overall rotation matrix that carries axes $\underline{x}\underline{y}\underline{z}$ into the axes $\underline{\alpha}\underline{\beta}\underline{\gamma}$ as shown in the Figure below.



2. Consider the diagram shown below. A robot base is set up 1m from a table. A frame $\{\mathbf{F_0}\}$ is attached to the base of the robot such that the $\underline{y}_0$ passes through the two legs of the table. The tabletop is 1m high and 1m square. A frame $\{\mathbf{F_1}\}$ is fixed to the edge of the table. A cube measuring 20 cm on each side is placed at the center of the table and a frame $\{\mathbf{F_2}\}$ is defined at the center of the cube. A camera is situated directly above the center of the cube (2m above the tabletop) and a frame $\{\mathbf{F_3}\}$ is attached to the camera. Find the homogenous transformation relating each of these frames to the base frame $\{\mathbf{F_0}\}$. Also find the homogenous transformation matrix that relates the frame $\{\mathbf{F_0}\}$ to $\{\mathbf{F_3}\}$.



3. Compute the homogenous transformation representing a translation of 3 units along x-axis followed by a rotation of 90^0 about the current z-axis followed by a translation of 1 unit along the fixed y-axis. Sketch the frames at the end of each transformation. Find the coordinates of the relocated origin with respect to the original frame in each case.