1. The gear forces shown below act in planes parallel to the yz plane. The force on gear A is 1000N. Gear A is 600 mm in diameter; gear C is 250 mm in diameter. Consider the bearings at O and B to be simple supports. Determine the reaction forces at O and B, and draw bending moment distribution on shaft OB. (Units: mm) (25%)

2. The following figure shows the slender 30 kg bar AB of length 1.2 meter moves in the vertical plane with its ends constrained to follow the smooth horizontal and vertical guides. If the 150 N force is applied at A with the bar initially at rest in the position for which \( \theta = 30^\circ \), calculate the resulting angular acceleration of the bar and the forces on the small end rollers at A and B. (25%)
3. The truss shown in the following figure supports one side of a bridge, and an identical truss supports the other side. The length of every member in the truss is 10 m. Floor beams carry vehicle loads to the truss joints. A 1000 kg car is stopped on the middle of the bridge. Find the force in each member of the truss. (25%)

4. As shown in the following figure, consider a bead of mass $m$ which is constrained to slide frictionlessly along a circular hoop of radius $r$. This hoop is rotating at the constant rate $\omega$ about a vertical axis. The location of the bead around the hoop is defined by $\theta$. (1) At equilibrium state(s) ($\dot{\theta} = 0$), calculate $\theta$. (20%) (2) Calculate the numerical value of $\theta$ if $r = 1$ m; $\omega = 1$ rad/s; $g = 9.8$ m/s$^2$. (5%)