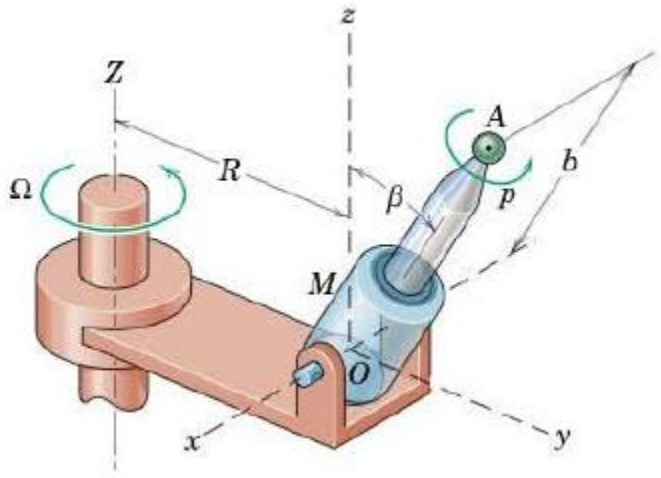
Indian Institute of Technology Guwahati

ME 101: Engineering Mechanics (2016-2017, Sem II)

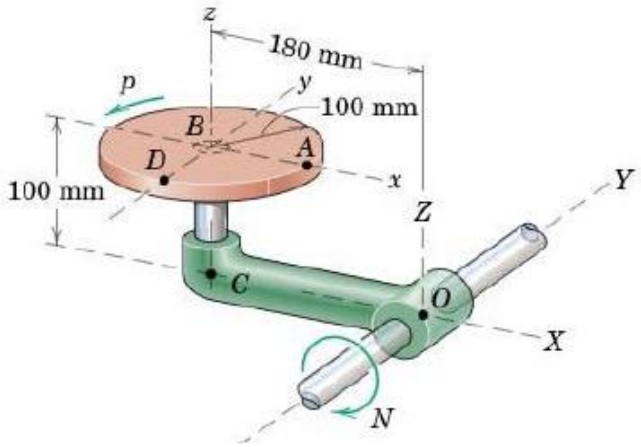
Tutorial 8 (27.03.2017) (Div 1 & 4)

Time: 8:00 AM – 8:55 AM **Full Marks**: 40

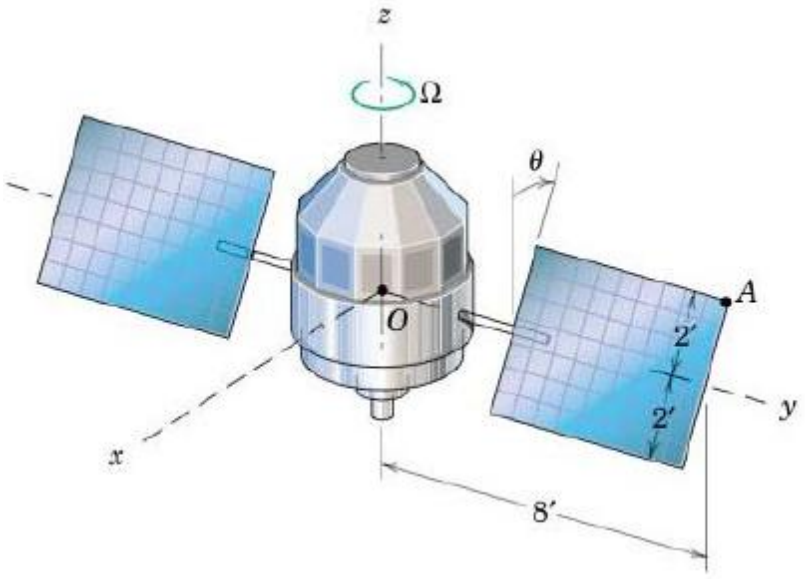
Ques.1 – The small motor *M* is pivoted about the *x*-axis through *O* and gives its shaft *OA* a constant speed *p* rad/s in the direction shown relative to its housing. The entire unit is then set into rotation about the vertical *Z*-axis at the constant angular velocity Ω rad/s. simultaneously, the motor pivots about the x-axis at the constant rate $\dot{\beta}$ for an interval of motion. Determine the angular acceleration α of the shaft *OA* in term of β. Express your result in term of the unit vector for the rotating *x*-*y*-*z* axes.



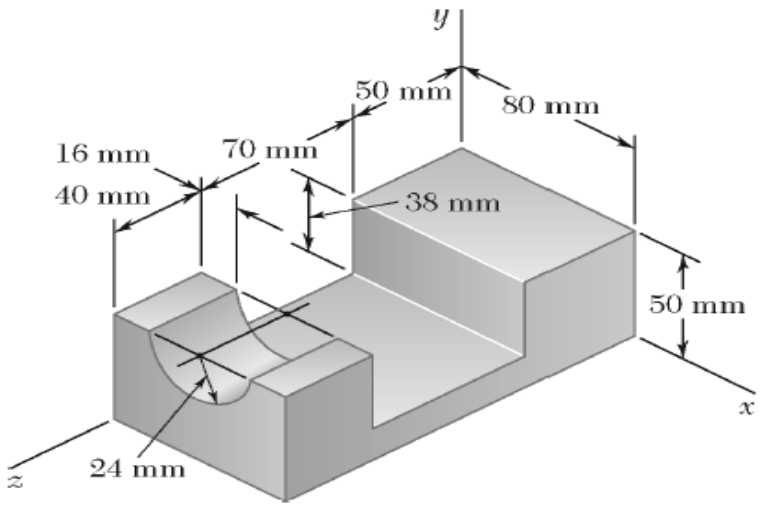
Ques.2 – The circular disk of 100-mm radius rotates about its *z*-axis at the constant speed *p* = 240 rev/min, and arm *OCB* rotates about *Y*-axis at the constant speed *N* = 30rev/min. Determine the velocity **v** and acceleration **a** of point *A* on the disk as it passes the position shown. Use reference axes *x*-*y*-*z* attached to arm *OCB.*



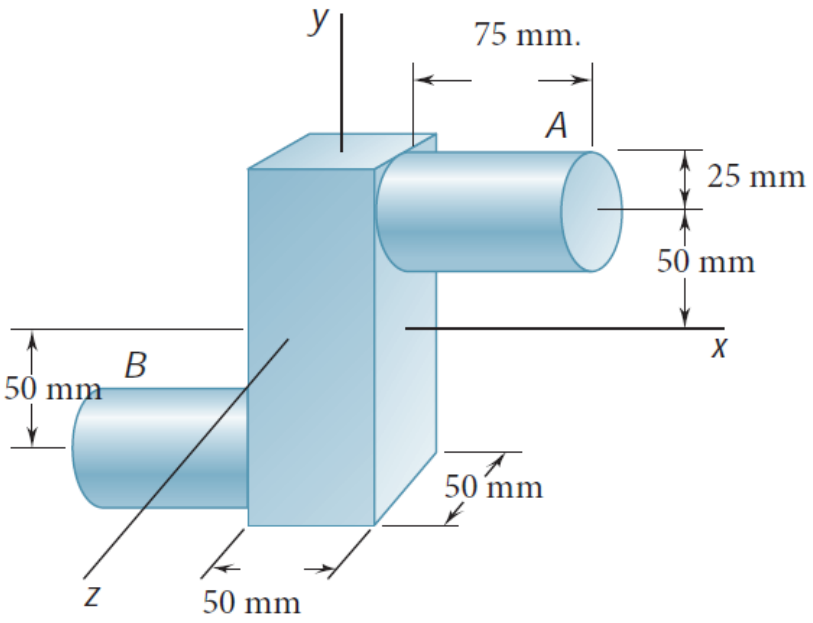
Ques.3- The center O of the spacecraft is moving through space with a constant velocity. During the period of motion prior to stabilization, the spacecraft has a constant rotational rate Ω = ½ rad/sec about its *z*-axis. The x-y-z axes are attached to the body of the craft, and the solar panels rotate about the y-axis at the constant rate $\dot{\theta}$ = ¼ rad/sec with respect to the spacecraft. If ω is the absolute angular velocity of the solar panels, determine $\dot{\omega}$. Also find the acceleration of point A when θ = 30°.



Ques.4– Determine the mass moment of inertia of the steel fixture shown with respect to *(a)* the *x*-axis, (b) the y-axis, (c) the z-axis. (The density of steel is 7850 kg/m^3.)



Ques.5 – A steel forging consists of a 150 x 50 x 50-mm rectangular prism and two cylinders of diameter 50 mm and length 75 mm as shown. Determine the moments of inertia of the forging with respect to the coordinate axes, knowing that the specific weight of steel is 7850 kg/m^3.



Ques.6 Compute the component of inertia tensor at the center of a solid sphere of uniform density ρ as shown in Fig.