Answer on Question#37769 - Physics - Astronomy

How to calculate the time period of a satellite to complete one revolution around earth's surface?

Solution

The orbit of satellite is stationary. From hence we get that the gravitational force $\frac{GMm}{r^2}$ is equal to centrifugal force $m\omega^2 r$. Here $G = 6.67 \cdot 10^{-11} \frac{m^3}{kg \cdot s^2}$ is gravitational constant, M is mass of Earth, r is radius of satellite's orbits, $\omega = \frac{2\pi}{T}$ is angular speed of satellite on orbit, T is period of one revolution around Earth, m is mass of satellite.

$$\frac{GMm}{r^2} = m\omega^2 r$$

$$\frac{GM}{r^2} = \omega^2 r$$

$$\omega = \sqrt{\frac{GM}{r^3}} \Rightarrow$$

$$T = 2\pi\sqrt{\frac{r^3}{GM}}$$

Answer:

$$T = 2\pi\sqrt{\frac{r^3}{GM}}$$