Gravitation

Newton’s Law of Universal Gravitation

- Any two bodies attract each other with force of gravity

\[ F_{12} = F_{21} = G \frac{m_1 m_2}{r^2} \]

- \( F_{21} \) and \( F_{12} \) are equal in magnitude and opposite in direction. They act along the line joining the centers of the objects.
- The weight of an object is the gravitational force exerted on it by the Earth. Near the Earth’s surface:

\[ mg = G \frac{mM_E}{R_E^2} \quad \Rightarrow \quad g = G \frac{M_E}{R_E^2} \approx 9.8 \, \text{m/s}^2 \]

- Motion of satellite around the earth

Centripedat force is gravity

\[ G \frac{mM_E}{r^2} = m \frac{v^2}{r} \quad \Rightarrow \quad v = \sqrt{\frac{GM_E}{r}} \]

period of orbital motion

\[ T = \frac{2\pi r}{v} = 2\pi \sqrt{\frac{r^3}{GM_E}} \]