

## GRAVITATION

### Questions Asked in Examination (2008-2020)

1. Obtain the expression for the Gravitational self-energy of a solid sphere of mass  $M$  and radius  $R$ . (*Curtailed*)
2. Obtain the expression for Gravitational potential and field at an (a) out-side point, (b) inside and (c) on the surface of a thin spherical shell.
3. (a) Obtain the expression for the intensity of Gravitational field due to a solid sphere of mass  $M$  and radius  $R$  at a point inside the sphere. (*Curtailed*)  
(b) A satellite of mass  $m$  is orbiting the earth in a circular orbit of radius  $r$ . It starts losing energy slowly at a constant rate  $C$  due to friction. If  $M$  and  $R$  denote the mass and radius of the earth respectively, show that the satellite falls on the earth in a time  $t = \frac{GMm}{2C} \left( \frac{1}{R} - \frac{1}{r} \right)$ .
4. Obtain an expression for Gravitational field due to a uniform solid sphere at a point inside the sphere. (*Curtailed*)
5. Obtain an expression for Gravitational field due to a uniform solid sphere at a point outside the sphere. (*Curtailed*)
6. Obtain the expression for the intensity of Gravitational field due to a solid sphere of mass  $R$  at a point at the surface and centre of the sphere. (*Curtailed*)
7. Calculate the Gravitational potential energy if a mass of 10 kg is placed at each corner of a cube having each edge equal to 0.25 meter.
8. Explain the following
  - (a) Gravitational field
  - (b) Gravitational potential
  - (c) Equipotential surface
9. Determine the Gravitational potential and field outside the spherical shell. Give their graphical representation also.
10. (a) Obtain an expression for the Gravitational field due to a uniform spherical shell of radius  $R$  at a point having distance  $r < R$  from the centre.  
(b) The Gravitational potentials of two thin spherical shells of the same surface density at their respective centres are in the ratio of 3:4. If the two shells coalesce into a single one and surface density remains unchanged, obtain the Gravitational potential at a point inside the new shell.
11. Write short notes on any two of the following:
  - (a) Gravitational potential and field due to a spherical shell at a point outside the shell.