UNIT 5

GRAVITATION

TEXTBOOK EXERCISE QUESTIONS

5.1 **Encircle the correct answer from the given choices.**

i. **Earth's gravitational force of attraction vanishes at:**
(a) 6400 km   (b) infinity
(c) 42300 km   (d) 1000 km

ii. **Value of g increases with the:**
(a) Increase in mass of body   (b) increase in altitude
(c) decrease in altitude   (d) none of the above

iii. **The value of g at a height one Earth's radius above the surface of Earth is:**
(a) 2 g   (b) 1/2 g
(c) 1/3 g   (d) 1/4 g

iv. **The value of g on moon's surface is 1.6 ms^{-2}. What will be the weight of a 100 kg body on the surface of the moon?**
(a) 100 N   (b) 160 N
(c) 1000 N   (d) 1600 N

v. **The altitude of geostationary orbits in which communications satellites are launched above the surface of Earth is:**
(a) 850 km   (b) 1000 km
(c) 6400 km   (d) 42300 km

vi. **The orbital speed of a low orbit satellite is:**
(a) zero   (b) 8 ms^{-1}
(c) 800 ms^{-1} (d) 8000 ms^{-1}

5.2 **What is meant by force of gravitation?**
Ans: In the universe, there exists a force between the bodies due to which everybody of the universe attracts every other body. This force is known as force of gravitation.

5.3 **Do you attract the earth or the Earth attracts you? Which one is attracting with a larger force? You or Earth?**
Ans: We attract the earth and Earth attracts us but Earth attracts us with larger force because the mass of the Earth is large.

5.4 **What is a field force?**
Ans: The gravitational pull of the Earth acting on the body whether the body is in contact with the Earth or not is called field force.

5.5 **Why earlier scientists could not guess about the gravitational force?**
Ans: The early scientists could not guess about the gravitational force due to lack of observations and lack of knowledge. Also it is a very weak force and its presence cannot be detected until mass of one body in much greater than mass of other body.

5.6 **How can you say that gravitational force is a field force?**
Ans: The gravitational force exists around the Earth and is acting on the bodies whether the bodies are in contact with the Earth or not. So, we can say that gravitational force is a field force.

5.7 **Explain, what is meant by gravitational field strength?**   (LHR 2013)

Ans: In gravitational field, the gravitational force acting per unit mass is called the gravitational field strength. It becomes weaker and weaker as we go away from the object applying the gravitational force.

5.8 **Why law of gravitation is important to us?**

Ans: Law of gravitation is important to us because it is used to calculate force of attraction between two masses. It is used to calculate the mass of Earth.

5.9 **Explain the law of gravitation?**

Ans: See Q. no.1 Long Question

5.10 **How the mass of Earth can be determined?**

Ans: See Q. no.3 Long Question

5.11 **Can you determine the mass of our moon? If yes, then what you need to know?**

Ans: Yes we can determine the mass of the moon by same method used to measure the mass of the Earth with the help of law of gravitation. The formula is:

$$M_m = \frac{g_m R_m^2}{G}$$

From the about relation it shows that we require,

g_m = gravitational acceleration on the surface of moon

R_m = Radius of moon

G = Gravitational constant

5.12 **Why does the value of g vary from place to place?** **(GRW 2015, LHR 2016)**

Ans: We know that

$$g = \frac{GM_e}{R^2}$$

The above relation shows that value of 'g' is inversely proportional to the square of distance of body from the centre of earth. Hence when distance body from centre of earth increase, the value of g decreases and vice versa.

5.13 **Explain how the value of g varies with altitude.**

Ans: See Q. no.4 Long Question

5.14 **What are artificial satellites?** **(LHR 2013)**

Ans: Scientists have sent many objects into space. Some of these revolve around the Earth. These are called artificial satellites.

Large numbers of artificial satellites have been launched in different orbits around the Earth. They take different time to complete their one revolution around the Earth depending upon their distance h from the Earth.

5.15 **How Newton's law of gravitation helps in understanding the motion of satellites.**

Ans: When a satellite moves around the earth in a nearly circular path, the gravitational force of attraction between earth and satellite provides the necessary centripetal force for its motion. This gravitational force can be found by using Newton's law of gravitation and finally we can find orbital speed of satellites.

5.16 **On what factors the orbital speed of a satellite depends?** **(GRW 2015, LHR 2016)**

Ans: As we know that

$$v_o = \sqrt{g_h (R + h)}$$

So, we can say that orbital speed depends upon the gravitational acceleration and distance between the center of earth and the satellite.

5.17 **Why communication satellites are stationed at geostationary orbits?** **(GRW 2013, 14)**

Ans: The satellites in geostationary orbits remain all the time in front of target part of Earth so that direction of receiver's dish do not to be changed.