CL20_Q1. What is meant by degeneracy of energy states in quantum systems?

Ans:

In quantum mechanics, for different combinations of quantum numbers n_x, n_y and n_z, we may obtain the same energy value but the wave functions are different. Such quantum states having the same energy are called degenerate. Degeneracy state means two or more stationary states of the same quantum-mechanical system may have the same energy even though their wave functions are not the same.

Ex: In case of 2D, there are two allowed states for the same energy value of $5Eo$. This state is then doubly degenerate. Similarly, in case of 3D, there are three allowed states for the same energy value of $6Eo$. This state is then triply degenerate.

CL20_Q2. Calculate the Eigen value of the electron in the lowest energy level, confined in a 2D potential box of side 0.1 nm.

Ans:

For the lowest energy level, $n_x = n_y = 1$

The energy of the electron in (11) state is

$$E_{11} = \frac{h^2}{8mL^2} (1^2 + 1^2) = \frac{2h^2}{8mL^2}$$
$$= 75.4 \ eV$$