The Lorentz force experienced by each electron is,

$$F_B = Bev_d ---------(1)\ (angle\ between\ B\ and\ v\ is\ 90)$$

Due to this Lorentz force, the free electrons shifted in one direction leaving equal amount of uncompensated positive charge in opposite direction. Due to this force, electrons are accumulated in one direction. And this difference in charge, electric field (E_H) will be set up on the conductor transverse to direction of current. This field is known as Hall field and potential due to the Hall field is known as Hall potential.

And electric force on the charge is,

$$F_e = eE_H ----------(2)$$

The accumulation process of electrons takes place until an equilibrium is established between Lorentz force and electrostatic force.

i.e. at equilibrium

$$F_e = F_B$$

$$eE_H = Bev_d$$

$$v_d = \frac{E_H}{B} -------(3)$$

We have, relationship between drift velocity and current:

$$I = v_d enA ----------(4)$$

$$v_d = \frac{I}{neA} ----------(5)$$

We know,

$$E_H = \frac{V_H}{d} ----------(6)$$

From equation, (3), (4), (5) and (6)

$$E_H = \frac{BI}{neA} ----------(7)$$

$$\frac{V_H}{d} = \frac{BI}{neA}$$

Also, $A = dxt$

Equation (viii) becomes,

$$\frac{V_H}{d} = B\frac{I}{nedt}$$

$$\boldsymbol{V_H = \frac{BI}{net}} ----------(\mathbf{8})$$

Equation (8) gives the value of hall voltage. This shows that the hall voltage is higher for smaller vale of 'n'.

Here the term,$\boldsymbol{H_c = \frac{1}{ne}}$ is called hall coefficient. Sign of hall coefficient gives nature of charge carriers. Electrons are negative charged leads to negative hall coefficient and hall coefficient is positive for positive charge.

Now, equation (viii) can be written as,

$E_H = \frac{BI}{neA}$

$E_H = \left(\frac{1}{ne}\right)\left(\frac{I}{A}\right)B$

$E_H = H_c$JB

$\boldsymbol{H_c = \frac{E_H}{BJ}}$----------(x) (Hall coefficient in terms of current density, magnetic field intensity and Electric field intensity).