Example 5) A steady current flows in a metallic conductor of nonuniform cross-section. The quantity / quantities constant along the length of the conductor is / are:

a)current, electric field and drift speed
b)drift speed only
c)current and drift speed
d)current only

Solution-

(d) $i = neAv_d$ where

v_d = drift speed, A = cross-sectional area.

A is different at different sections, since the conductor is non-uniform, hence v_d is different.

Again electric field $E = \dfrac{v}{l} = \dfrac{iR}{l} = \dfrac{i\rho l}{Al} = \dfrac{i}{\sigma A}$.

E does not remain constant as A varies from section to section of a non-uniform conductor.

Current is the only quantity that remains constant along the length of the conductor.

This is because all the conductor is equivalent to the series combination of elements of different croses sections