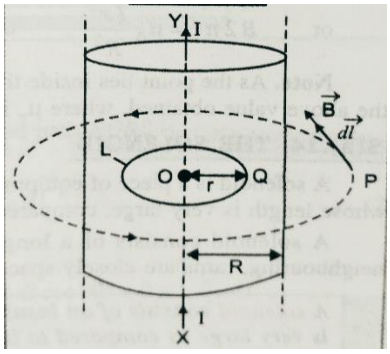
2. magnetic field due to current through a very long circular cylinder –

Consider an infinite long straight thick cylinder of radius R carrying current 'I' . We have to find the magnetic field at a point .



Case1- When point p is outside the cylinder , (r>R) :-

From Ampere's circuital law $\oint B.dl = \mu_0 I$

$\oint B.dl\ coso = \mu_0 I$

Or, $B\oint dl = \mu_0 I$

Or, $B \cdot 2\prod r = \mu_0 I$

And hence , $B = \mu_0 I/2\prod r$ ..... req. eq.

i.e. B α 1/r ;

Case 2 – When point 'Q' is inside the cylinder (r < R) :-

Let current is distributed uniformly throughout the cross-section of the conductor . Then the current through the closed path is given by , $I' = (I/\prod R^2)\prod r^2 = Ir^2/R^2$;

From Ampere's circuital law

$\oint B.dl\ coso = \mu_0 \mu_r I'$ Or , $\oint B.dl = \mu_0 \mu_r Ir^2/R^2$;

$B\oint .dl = \mu_0 \mu_r Ir^2/R^2$; Or, $B = \mu_0 \mu_r Ir^2/R^2 2\prod r = \mu_0 \mu_r Ir/2\prod R^2$;

i.e. B α r ;

if we plot the graph B V/s r we get the following graph ,