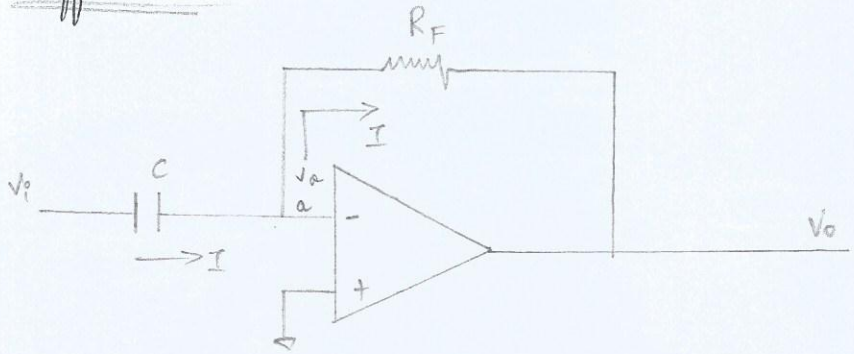
2.2.1. QlM	**The institution assesses the learning levels of the students and organizes special Programmes for advanced learners and slow learners**

Assignments

Gowtham Reddy
2nd year, ECE

LIC Assignment - 1

Ideal Differentiator :-



The o/p voltage (V_o) produces the Differentiation of i/p voltage V_i.

Nodal equation at 'a',

$$C_F \frac{d(V_i - V_a)}{dt} + \frac{V_o - V_a}{R_F} = 0$$

Assume $V_a = 0$,

$$C \frac{dV_i}{dt} + \frac{V_o}{R_F} = 0$$

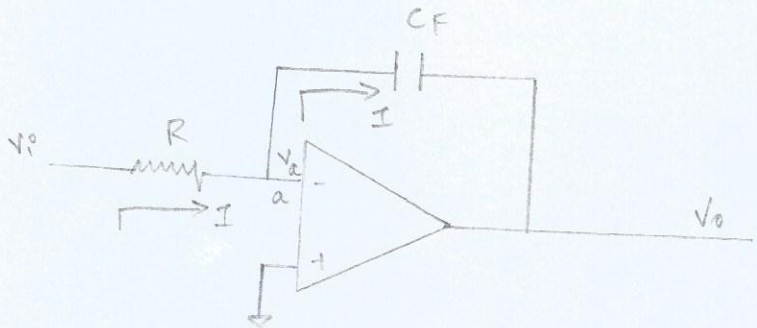
$$\frac{V_o}{R_F} = -C \frac{dV_i}{dt}$$

$$\boxed{V_o = -C R_F \frac{dV_i}{dt}}$$

PRINCIPAL
T.J.S. ENGINEERING COLLEGE
Peruvoyal, Kavaraipettai,
Gummidipoondi Taluk,
Thiruvallur Dist - 601 206.

T.J.S.E.C. PERUVOYAL, KAVARAIPETTAI

Ideal Integrator :-



The O/P Voltage (V_o) produces the integration of Voltage (V_i).

Nodal equation at 'a'

$$\frac{V_i - V_a}{R} + C_F \frac{d(V_o - V_a)}{dt} = 0$$

Assume $V_a = 0$,

$$\frac{V_i}{R} + C_F \frac{dV_o}{dt} = 0$$

$$C_F \frac{dV_o}{dt} = -\frac{V_i}{R}$$

$$dV_o = -\frac{V_i\, dt}{R C_F}$$

Taking integral on both side,

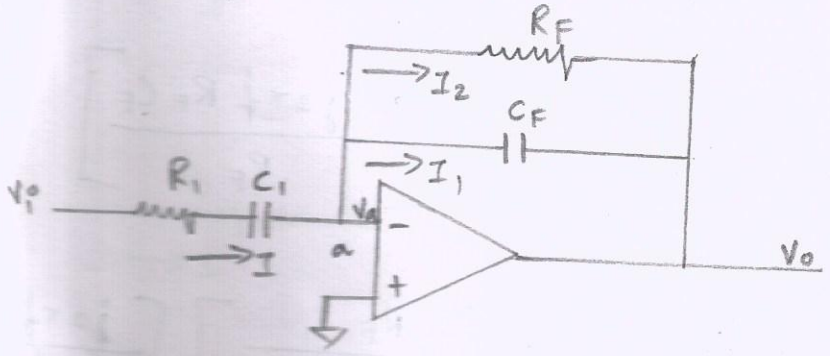
$$\int dV_o = -\int \frac{V_i\, dt}{R C_F}$$

$$\boxed{V_o = -\frac{1}{R C_F} \int V_i\, dt}$$

T.J.S. ENGINEERING COLLEGE T.J.S.E.C. KAVARAIPETTAI

PRINCIPAL
T.J.S. ENGINEERING COLLEGE
Peruvoyal, Kavaraipettai
Gummidipoondi Taluk
Thiruvallur Dist - 601 206.

Practical Differentiator :-



i/p

Nodal equation at 'a'

$$I = I_1 + I_2$$

$$\frac{V_i - V_a}{R_1 + 1/j\omega C_1} = C_F \frac{d(V_a - V_o)}{dt} + \frac{V_a - V_o}{R_F}$$

assume $V_a = 0$,

$$\frac{V_i}{R_1 + 1/j\omega C_1} = -C_F \frac{dV_o}{dt} - \frac{V_o}{R_F}$$

Taking laplace transform,

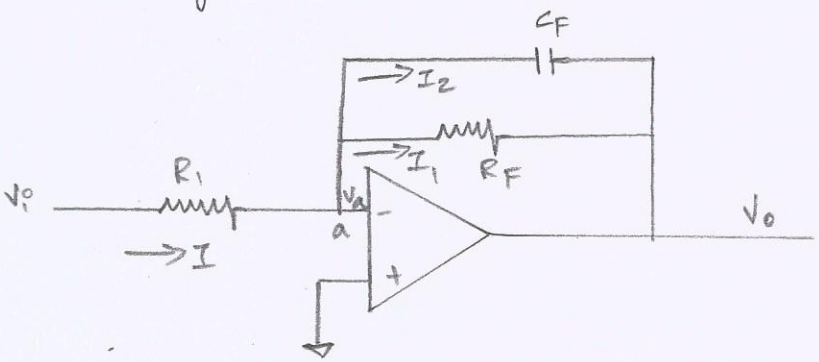
$$\frac{V_i(s)}{\frac{j\omega R_1 C_1 + 1}{j\omega R_1 C_1}} = -C_F \, s.V_o(s) - \frac{V_o(s)}{R_F}$$

$$\frac{V_i(s)}{\frac{j\omega R_1 C_1 + 1}{j\omega C_1}} = -V_o(s)\left[\frac{1}{R_F} + sC_F\right]$$

$$\frac{V_i(s)}{\frac{j\omega R_1 C_1 + 1}{j\omega C_1}} = -V_o(s)\left[\frac{1 + sC_F R_F}{R_F}\right]$$

PRINCIPAL
T.J.S. ENGINEERING COLLEGE
Peruvoyal, Kavaraipettai,
Gummidipoondi Taluk.

Practial Integrator :-



Nodal equation at 'a',

$$I = I_1 + I_2$$

$$\frac{V_i - V_a}{R_1} = \frac{V_a - V_o}{R_F} + C_F \frac{d(V_a - V_o)}{dt}$$

assume $V_a = 0$,

$$\frac{V_i}{R_1} = \frac{-V_o}{R_F} - C_F \frac{d V_o}{dt}$$

Taking laplace transform,

$$\frac{V_i(s)}{R_1} = \frac{-V_o(s)}{R_F} - C_F s . V_o(s)$$

$$\frac{V_o(s)}{V_i(s)} = -\left[\frac{R_F}{1 + s C_F R_F}\right] \frac{1}{R_1}$$

Put $s = j\omega$, $\omega = 2\pi f$

$$A = \frac{V_o(s)}{V_i(s)} = -\left[\frac{R_F/R_1}{1 + j 2\pi f C_F R_F}\right]$$

$$= -\left[\frac{R_F/R_1}{1 + j f/F_H}\right]$$

$$|A| = \left[\frac{R_F/R_1}{1 + j f/F_H}\right]$$