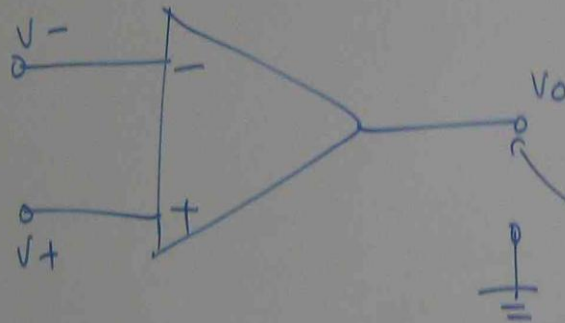


# ANALOGUE ELECTRONICS 1 (HO 45)

## BASIC OP AMP CIRCUITS

THE OPERATIONAL AMPLIFIER IS A HIGH GAIN DC AMPLIFIER WITH DIFFERENTIAL INPUT AND SINGLE ENDED OUT PUT.



THE AMPLIFIER AMPLIFIES THE DIFFERENCE VOLTAGE BETWEEN TWO INPUTS

SINGLE ENDED OUT PUT.

THE OUT PUT VOLTAGE BETWEEN  $V_o$  TERMINAL AND GROUND.

$V(-)$  = INVERTING INPUT

$V(+)$  = NON INVERTING INPUT

IC 741, 301

741  $\rightarrow$  MAXIMUM SUPPLY VOLTAGE =  $\pm 18V$  (DUAL SUPPLY)  
36V (SINGLE SUPPLY)

### IDEAL OPERATIONAL AMPLIFIER

- \* THE OP-AMP HAS INFINITE GAIN  $A_{VOL} = \infty$  (VOLTAGE GAIN  $\approx 200,000$ )
- \* INFINITE INPUT RESISTANCE BETWEEN INPUT TERMINAL AND GROUND (IN  $\rightarrow$  GND)
- \* THE OUTPUT RESISTANCE OF THE OP-AMP IS ZERO.

### LINEAR AMPLIFIER AND NEGATIVE FEEDBACK

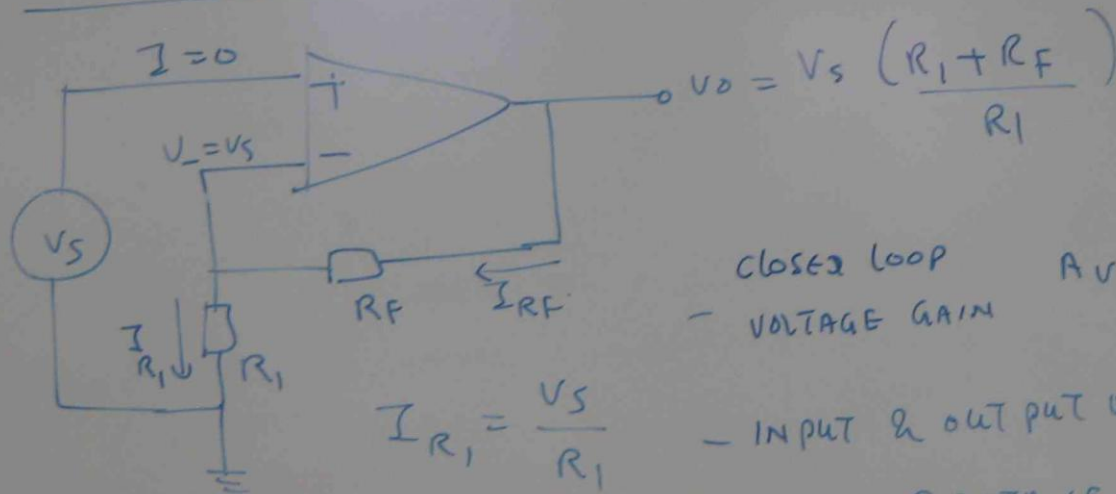
LINEAR AMPLIFIER - THE OUTPUT HAS THE SAME SHAPE AS INPUT.

NEGATIVE FEEDBACK (NFB) - A METHOD OF REDUCING THE EFFECTIVE VOLTAGE GAIN OF A CIRCUIT IN A CONTROLLED MANNER AND THEREBY, LINEARIZE THE AMPLIFIER CIRCUIT.

NEGATIVE FEEDBACK  
VOLTAGE GAIN

CLOSED LOOP  
VOLTAGE GAIN

## 2) NON INVERTING AMPLIFIER



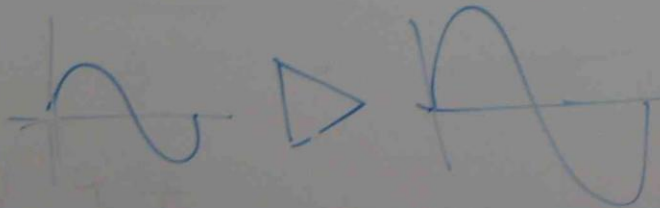
CLOSED LOOP  
- VOLTAGE GAIN

$$A_v = \frac{V_o}{V_s} = \left( 1 + \frac{R_F}{R_1} \right)$$

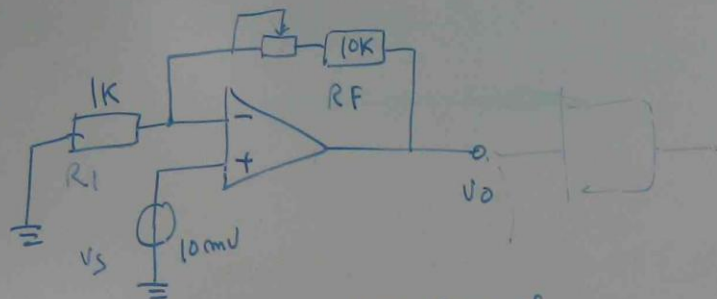
- INPUT & OUTPUT VOLTAGES ARE INPHASE

- INPUT RESISTANCE  $\frac{V_s}{I} = \infty$

- OUTPUT RESISTANCE  $\approx 0$



Pb 1



(a) WHAT IS THE MINIMUM VOLTAGE GAIN OF THE CIRCUIT

(b) TO GET A VOLTAGE GAIN OF 61 ?

WHAT SHOULD BE THE RESISTANCE OF THE POTENTIOMETER?

(c) WHAT IS THE SIGNAL CURRENT DRAWN FROM THE SOURCE?

(d) IF THE GAIN IS SET TO 30, WHAT IS THE OUTPUT VOLTAGE?

(e) IF THIS AMPLIFIER IS DRIVING ANOTHER AMPLIFIER OF INPUT RESISTANCE  $5k\Omega$ , WHAT WILL BE THE OUTPUT VOLTAGE OF THE FIRST AMPLIFIER?

(f) IF THE SIGNAL SOURCE HAS INTERNAL RESISTANCE  $1k\Omega$ , WHAT WILL BE THE OUTPUT VOLTAGE?

$$(a) A_V = \left(1 + \frac{R_F}{R_1}\right) \\ = \left(1 + \frac{10K}{1K}\right) = 11$$

$$(b) A_V = \left(1 + \frac{R_F}{1}\right)$$

$$61 = 1 + \frac{R_F}{1} \\ R_F = 61 - 1 = 60k\Omega$$

(c) 0

$$(d) \text{ OUTPUT VOLTAGE} = \text{GAIN} \times \text{INPUT VOLTAGE} \\ = 30 \times 10mV = 0.3V$$

(e) UNCHANGED.