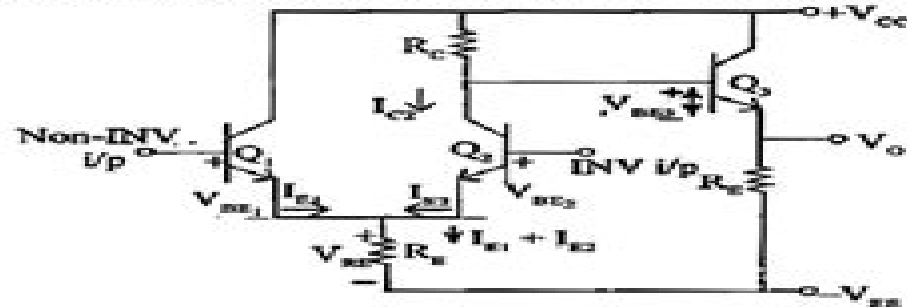


MODULE – 1

Operational Amplifier Fundamentals

- The basic circuit of an operational amplifier is shown below.



- Transistor Q_1 & Q_2 constitute a differential amplifier, which produces a voltage change at the collector of Q_2 when a difference input voltage is applied to the bases of Q_1 & Q_2 . Assume Q_1 & Q_2 is perfectly matched.
- Transistor Q_3 operates as an emitter follower to provide a low output impedance.
- $V_c = V_{cc} - V_{RC} - V_{BE}$
- Input voltage range and output voltage range

Parameters	Condition	Min	Typ	Max	Unit
Input voltage range		± 12	± 13		V
Output voltage range	$R_L \geq 10 \text{ k}\Omega$	± 12	± 14		V
	$R_L \geq 2 \text{ k}\Omega$	± 10	± 13		V

2. Common Mode & Supply Rejection

- The two input terminals are connected together and both raised to 1 V above ground level is known as common mode input.
- The common mode gain is the output voltage change due to the common mode input divide by common mode input voltage.

$$A_{cm} = \frac{V_{o(cm)}}{V_{i(cm)}}$$

- The success of the op-amp in rejecting common mode inputs is defined in the common mode rejection ratio (CMRR).
- This is the ratio of open - loop gain M to common mode gain A_{cm}

$$\text{CMRR} = \frac{M}{A_{cm}}$$

- The power supply rejection ratio (PSRR) is a measure of how effective the operational amplifier is in dealing with variations in supply voltage.

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Douglas J. Hamilton, William G. Howard



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