SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

19EET202 / ANALOG ELECTRONICS

II YEAR / III SEMESTER

UNIT-4: AMPLIFIERS AND SWITCHING CIRCUITS

1

INTRODUCTION-transformer coupled class a

What We'll Discuss

TOPIC OUTLINE

What is Transformer coupled class A?

Circuit Operation of Transformer

Transformer Action

Applications

2

Introduction

- Transformer Coupled Class A also referred to single ended power amplifier and Single ended-only one transistor
- Class A power transformers include power transformers with high voltage winding of 69 kv and below
- Class A operation ensure that the transistor conducts throughout the entire cycle minimizing distortion but resulting in lower efficiency due to continuous power consumption

APPLICATIONS

- The transformer coupled amplifier is commonly used for amplification of RF(radio frequency) signal
- It is mostly used for impedance matching between individual stages
- It is used to transfer power to the low impedance load such as loud speaker
- It is widely used as voltage amplifier in the final stage of multi stage amplifier
- In order to match the impedance a step down transformer of proper turn ratio is used
- The transformer coupling is generally used when load is small
- It is mostly used for power amplification

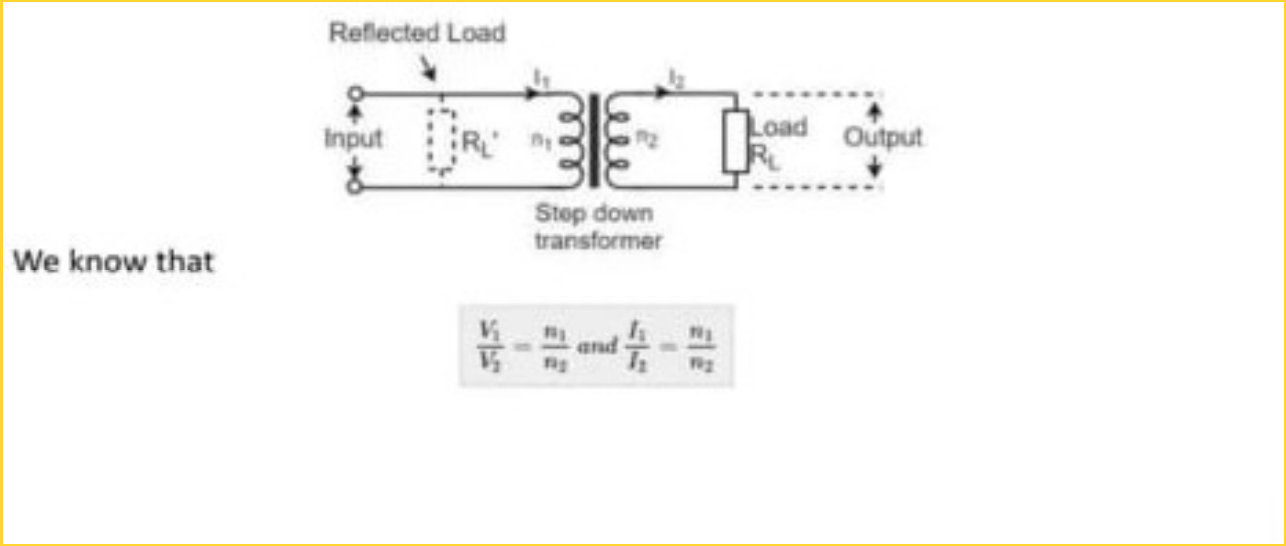
Construction

This is similar to the normal amplifier circuit but connected with a transformer in the collector load

- Here R1 and R2 provide potential divider arrangement
- Ce is the bypass capacitor
- Re to prevent a.c.voltage
- The transformer used here is a step-down transformer
- The low impedance secondary of the transformer is connected to the load

TRANSFORMER'S ACTION

- The transformer used in the collector circuit is for the impedance matching



We know that

$$\frac{V_1}{V_2} = \frac{n_1}{n_2} \text{ and } \frac{I_1}{I_2} = \frac{n_1}{n_2}$$

Or

$$V_1 = \frac{n_1}{n_2} V_2 \text{ and } I_1 = \frac{n_1}{n_2} I_2$$

Hence

$$\frac{V_1}{I_1} = \left(\frac{n_1}{n_2}\right)^2 \frac{V_2}{I_2}$$

But V1/I1 = RL' = effective input resistance

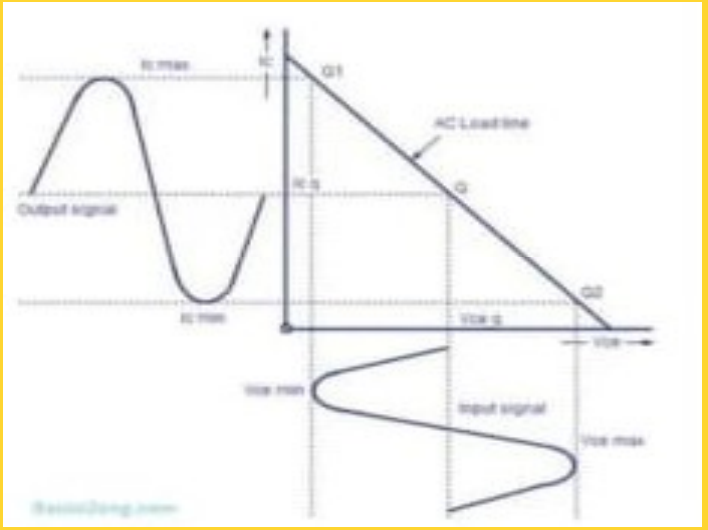
And V2/I2 = RL = effective output resistance

Therefore,

$$R'_L = \left(\frac{n_1}{n_2}\right)^2 R_L = n^2 R_L$$

CIRCUIT OPERATION

If the peak value of the collector current due to signal is equal to zero signal collector current, then the maximum a.c. power output is obtained. So, in order to achieve complete amplification, the operating point should lie at the center of the load line.



EFFICIENCY DERIVATION

- The power loss in the primary is assumed to be negligible, as its resistance is very small.
- The input power under dc condition will be

$$(P_{in})_{dc} = (P_{tr})_{dc} = V_{CC} \times (I_C)_Q$$

- Under maximum capacity of class A amplifier, voltage swings from (Vce)max to zero and current from (Ic)max to zero.
- Hence

$$V_{rms} = \frac{1}{\sqrt{2}}\left[\frac{(V_{ce})_{max} - (V_{ce})_{min}}{2}\right] = \frac{1}{\sqrt{2}}\left[\frac{(V_{ce})_{max}}{2}\right] = \frac{2V_{CC}}{2\sqrt{2}} = \frac{V_{CC}}{\sqrt{2}}$$

$$I_{rms} = \frac{1}{\sqrt{2}}\left[\frac{(I_C)_{max} - (I_C)_{min}}{2}\right] = \frac{1}{\sqrt{2}}\left[\frac{(I_C)_{max}}{2}\right] = \frac{2(I_C)_Q}{2\sqrt{2}} = \frac{(I_C)_Q}{\sqrt{2}}$$

Therefore,

$$(P_O)_{ac} = V_{rms} \times I_{rms} = \frac{V_{cc}}{\sqrt{2}} \times \frac{(I_c)_Q}{\sqrt{2}} = \frac{V_{cc} \times (I_c)_Q}{2}$$

Therefore,

$$\text{Efficiency} = \frac{(P_O)_{ac}}{(P_{in})_{dc}}$$

Or,

$$(\eta)_{collector} = \frac{V_{cc} \times (I_c)_Q}{2 \times V_{cc} \times (I_c)_Q} = \frac{1}{2}$$

$$= \frac{1}{2} \times 100 = 50\%$$

ADVANTAGES

- The advantages of transformer coupled class A power amplifier are as follows.No loss of signal power in the base or collector resistors.

- Excellent impedance matching is achieved.

- Gain is high.DC isolation is provided.

DISADVANTAGES

- The disadvantages of transformer coupled class A power amplifier are as follows.
- Low frequency signals are less amplified comparatively.
- Hum noise is introduced by transformers. Transformers are bulky and costly.
- Poor frequency response.

THANK YOU