GOVERNMENT POLYTECHNIC COLLEGE BHILWARA

II MID TERM: 14th February 2018

III- Year Electronics **Maximum Marks: 15**

EL-301- Electronic Circuits

Attempt all questions/ सभी प्रश्नों का उत्तर देना अनिवार्य है

1. An amplifier has AC output power of 25 watts at 20% harmonic distortion. What will be the AC Power due to fundamental frequency? [2 marks]
2. What is Feedback? What are the different types of feedbacks used in an amplifier? [3 marks]
3. What are the different types of distortions that take place in an amplifier? Explain any one in detail.[3 marks]
4. Explain RC Phase Shift oscillator with circuit diagram. Also calculate the frequency of oscillation [3 marks]
5. What is the effect of negative feedback on the gain of an amplifier? Explain with suitable equations [4 marks]

II - Mid Term (Electronics Engineering)
EL-301 (Electronic Circuits)

(1) Given Harmonic distortion = 20%
$= 0.2 = D_H$

let AC power due to fundamental $= P_1$
AC output power $P_{out} = 25$ watts

So, $P_{out} = P_1 (1 + D_H^2)$

$$P_1 = \frac{P_{out}}{1 + D_H^2} = \frac{25}{1 + (0.2)^2} = \frac{25}{1.04}$$

So, power due to fundamental component $\boxed{P_1 = 24.03\ W}$

(2) Feedback is the process of mixing a part of the output signal with the applied input

The signal which is mixed with the applied input is known as feedback signal (X_f)

$$X_f \propto X_o$$

or $\boxed{X_f = \beta X_o}$

If the feedback signal is in phase with the applied input, it is known as positive or regenerative feedback.

or $\boxed{X_i = X_s + X_f}$

In this case the feedback signal gets added to the applied input.

If the feedback signal is out of phase with the applied input, it gets subtracted from the input. This is known as negative feedback

$$X_i = X_s - X_f$$

Here X_s : applied input
X_f : Feedback signal
X_i : Net input.

③ If the output signal does not resemble the input signal, the output is said to be distorted.

Distortions in an amplifier can be of 3 types
(a) Non linear / harmonic distortion
(b) Phase shift distortion
(c) Frequency distortion

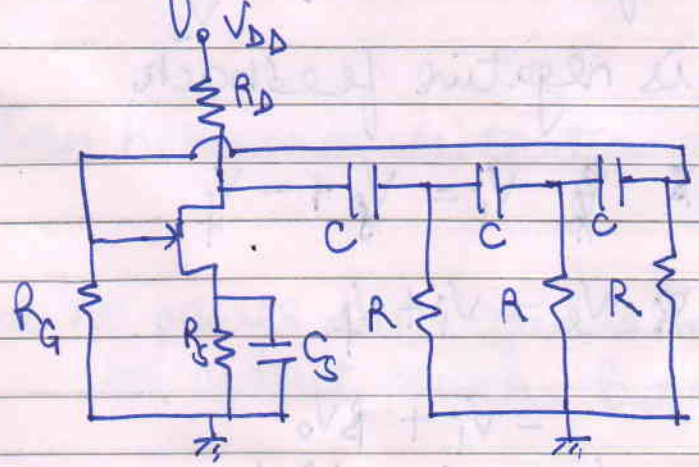
Phase shift distortion

It refers to providing unequal phase shifts to different frequencies present in the input signal.

It is due to the presence of reactive elements in a circuit (large capacitors at low frequencies and small capacitors at high frequencies)

→ An RC coupled amplifier provides a phase shift of 180° at medium frequencies, less than 180° at high frequencies and more than 180° at low frequencies

(4) RC phase shift FET oscillator



It consists of an CS-FET amplifier and an RC feedback network.

→ CS amplifier provides a phase shift of 180° between input and output voltage waveform

→ RC network provides an additional phase shift of 180° so that the total phase shift of the feedback loop becomes 360° and the circuit oscillates at a frequency f_o

→ Minimum 3 RC networks are used to create a phase shift of 180°

→ Identical RC networks are needed to make the analysis and design simple.

→ Frequency of oscillation $\boxed{f_o = \frac{1}{2\pi\sqrt{6}RC}}$

(5) Effect of Negative feedback on Gain

Let Gain without feedback (open loop gain) $A_{OL} = \frac{V_o}{V_i}$

Let Gain with feedback $(A_{CL}) = \frac{V_o}{V_s}$

Also, since it is negative feedback hence

$$V_i = V_s - V_f$$

$$V_s = V_i + V_f$$

$$= V_i + \beta V_o$$

$$V_s = V_i + A\beta V_i$$

$$V_s = V_i (1 + A\beta)$$

Hence $$A_{CL} = \frac{V_o}{V_i (1 + A\beta)}$$

Or $$A_{CL} = \frac{A_{OL}}{1 + \beta A_{OL}}$$

Thus the gain of the amplifier decreases by a factor of $(1 + A\beta)$ when negative feedback is used

(P. D. Upadhyay)
Electronics