P.NO 1

Department of Electrical Engineering

Assignment

24-06-2020

Course details

Course title:- Electronic circuit design

Module :- 4th

Instructor :- Engr Mujtaba Ihsan

Total Marks:- 50

Student details

Name:- Maaz Khan

Student ID :- 14569

Q-1 (a) Discuss the darlington connection for Multistage amplifiers.

Ans:-

→ Multistage amplifiers:-

Two or more amplifiers can be connected to increase the gain of an ac signal. The overall gain can be calculated by simply multiplying each gain together.

$$A_V' = A_{V_1} A_{V_2} A_{V_3} \ldots\ldots$$

→ Darlington connection:-

The main feature is that the composite transistor acts as a single unit with a current gain that is the product of the current gains of the individual transistors. It provides high current gain than a single BJT. The connection is made using two separate transistors having current gains of β_1 and β_2.

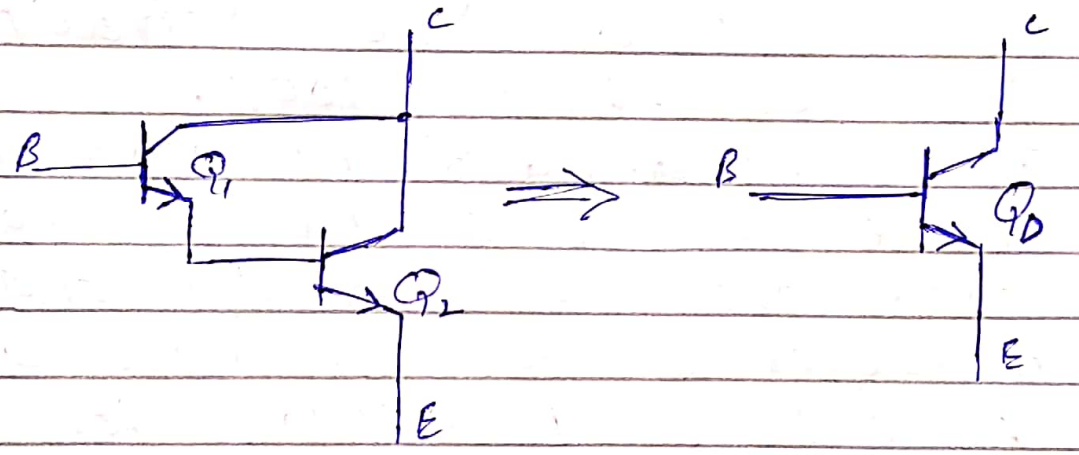
So, the current gain

$$\beta_D = \beta_1 \beta_2$$

If $\beta_1 = \beta_2 = \beta$ then,

The Darlington connection provides a current gain of

$$\beta_D = \beta^2$$



(b) The input of a certain regulator increases by 4.5 v. As a result, the output voltage increases by 0.062 v. The nominal output is 40 v. Evaluate the line regulation in both % and in %/V.

Sol:-

$$\text{Line Reg} = \frac{0.062}{4.5} \times 100\% = 1.377\%$$

Ep

$$\text{Line Reg} = \frac{\frac{0.062}{40} \times 100\%}{4.5} = 0.034\%/V$$

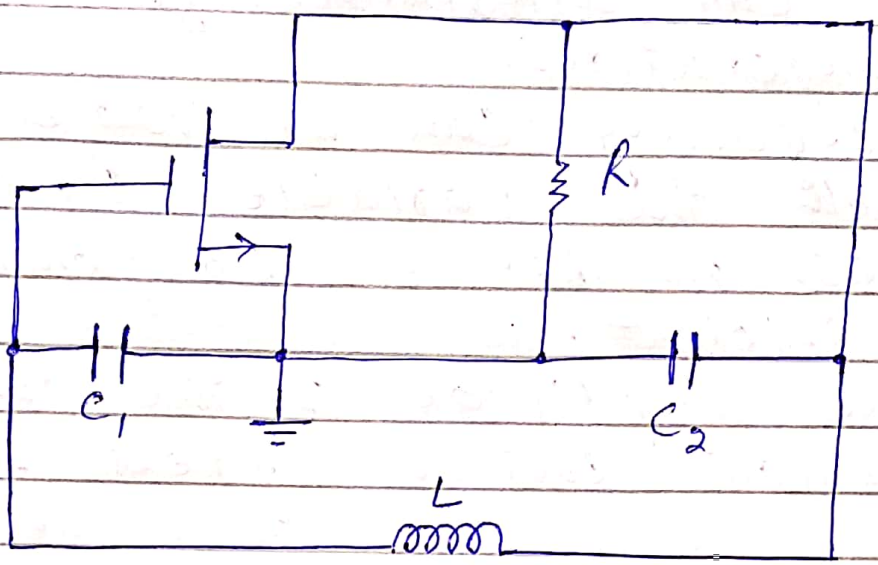
Q:-2 Explain Colpitts and Hartley oscillators.

Ans:-

→ Colpitts oscillators:

The Colpitts oscillators is type of oscillator that uses an LC circuit in the feed-back loop.
The feed-back network is made up of a pair of tapped capacitors (C_1 and C_2) and an inductor L to produce a feed back necessary for oscillations.
The output voltage is developed across C_1. The feed back voltage is developed across C_2.

* When the collector supply is given, a transient current is produced in the oscillatory or tank circuit. The oscillatory current in the tank circuit produces a.c voltage across C_1 which are applied to the base emitter junction and appear in the amplified form in the collector circuit and supply losses to the tank circuit.



→ Frequency: The equation for frequency of colpitts oscillator is given as

$$f = \frac{1}{2\pi\sqrt{LC_T}}$$

Here, C_T is the total capacitance of C_1 and C_2 connected in series.

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_T = \frac{C_1 \times C_2}{C_1 + C_2}.$$

→ Advantages:-

* The frequency stability is high.

* It can withstand high and low temperatures.
* Frequency can be varied by using both the variable capacitor.
* Less number of components are sufficient.
* The amplitude of the output remains constant over a fixed frequency range

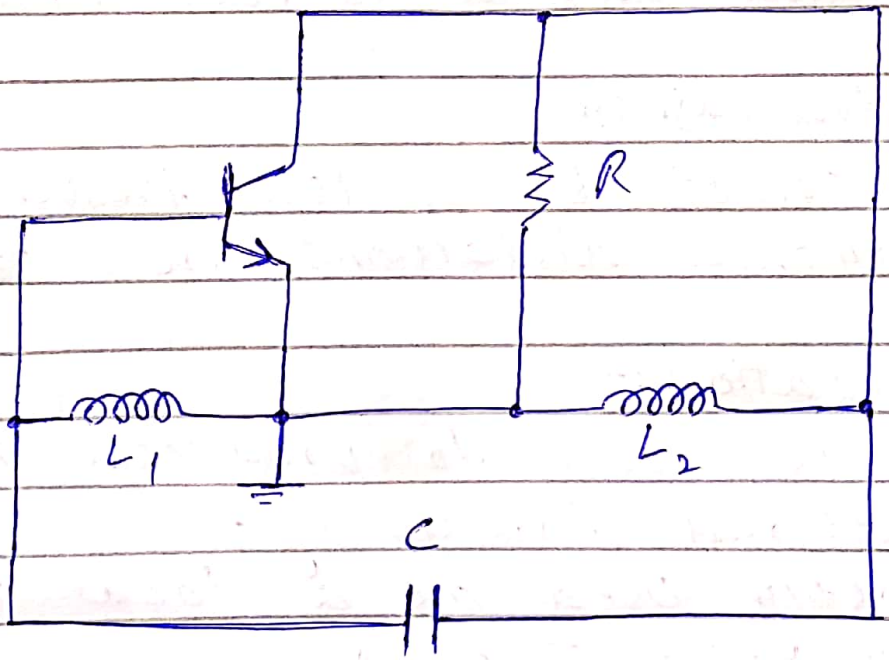
→ Applications :-

* It is used in Mobile applications
* It is used as R.F oscillator.
* It can be used as high frequency sinewave generator.
* It can be used as a temperature sensor with some associated circuitry.
* Mostly used as a local oscillator in radio receivers.

→ The colpitts oscillator is designed to eliminate the disadvantages of Hartly oscillator and is known to have no specific disadvantages.

→ Hartly oscillator :-

The Hartly oscillator is almost identical to the colpitts oscillator.
The primary difference is that the feed back network of the Hartly oscillator ~~used~~ uses tapped inductors (L_1 and L_2) and a single capacitor C.



* When the collector supply is given, a transient current is produced in the oscillatory or tank circuit. The oscillatory current in the tank circuit produced are voltage across L_1.

→ The frequency of oscillation:

$$\omega_0 = \frac{1}{\sqrt{(L_1+L_2)C}}$$

→ Advantages:-

* Instead of using a large transformer, a single coil can be used as an auto-transformer.
* Frequency can be varied by employing either a variable capacitor or a variable inductor.
* Less number of components are sufficient
* The amplitude of the output remains constant over a fixed frequency range.

→ Disadvantages:-

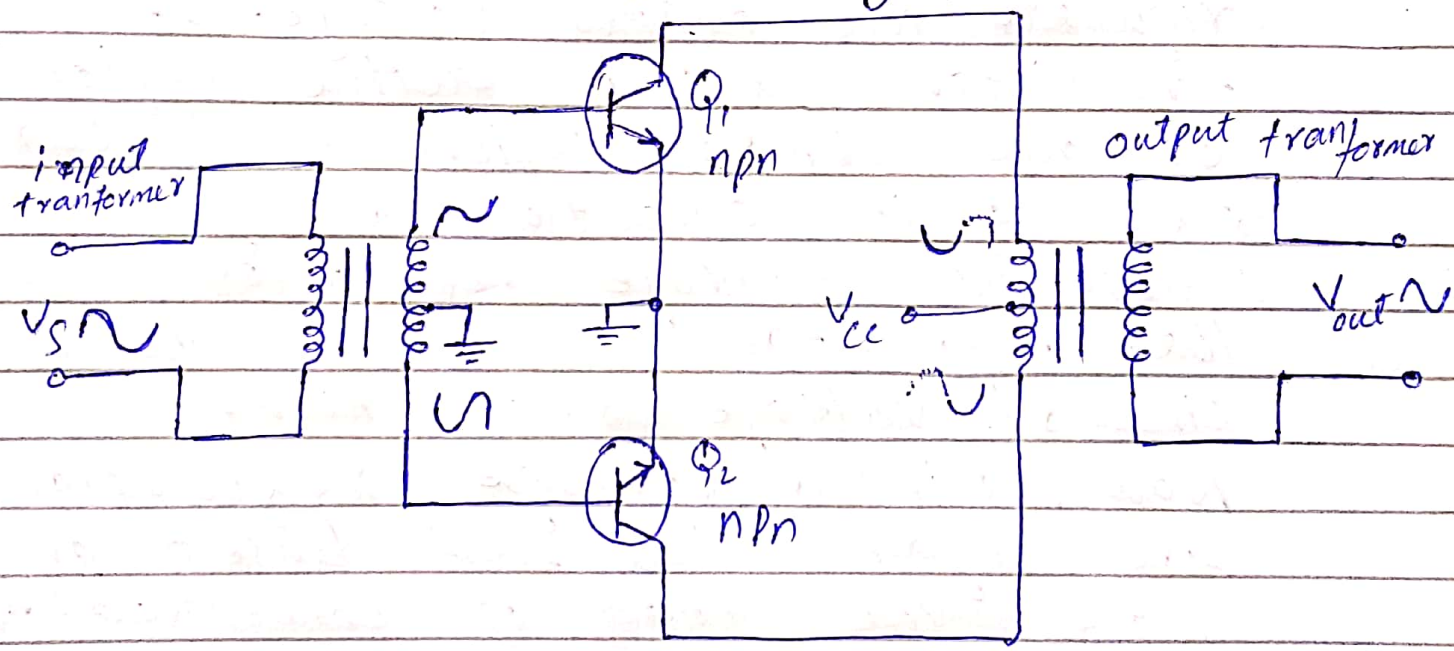
* It cannot be a low frequency oscillator.
* Harmonic distortions are present.

→ Application:-

* It is used to produced a sinewave of desired frequency.
* Mostly used as a local oscillator in radio receivers.
* It is also used as R.F oscillators.

Q:-3 (a) Describe the idea behind class B amplifiers.

Ans:- Class B amplifiers are opposite of class A, both the output devices are never allowed to be on at the same time. Each output devices is on for exactly one half of a complete sinusoidal signal cycle.



→ Here Q_2 conducts during the negative half-cycle and Q_1 conducts during the positive half-cycle.

→ class B amplifiers are used in low cost designs or design where sound quality is not that important.

(b) Explain the types of voltage regulators and their purposes.

Ans:- Voltage regulator can be classified into two types:

① → Linear voltage Regulators:-

Transistor can be operated either in its active region or as a switch in order to regulate the output voltage. If the transistor stays in active region or the ohmic - region or linear region of its operation during the course of voltage regulation, then the regulator is called as a linear voltage regulation.

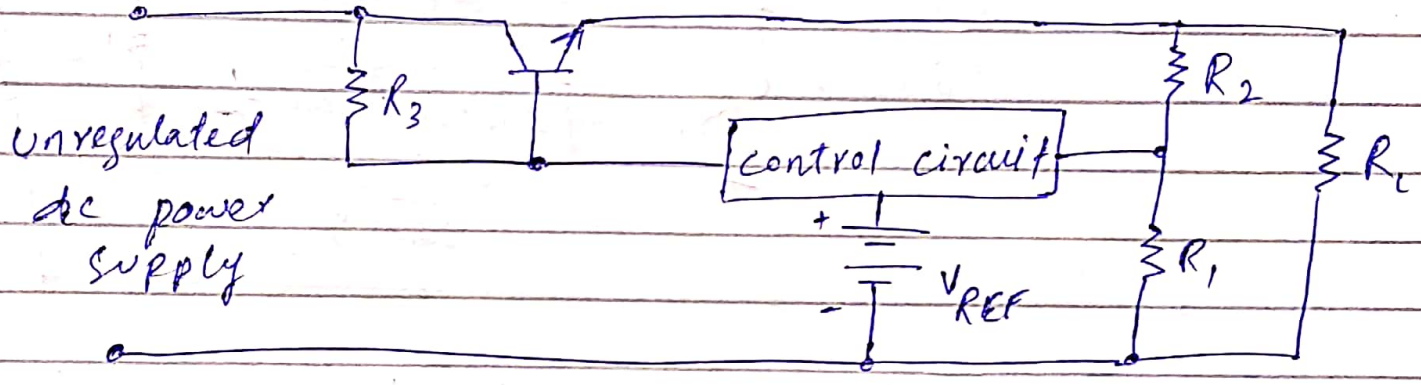
Now, Linear voltage Regulation are again classified based on how the load is connected. They are

⇒ series voltage regulators.
⇒ Shunt voltage regulators.

⇒ series voltage regulator :-

In linear voltage regulator, if the active pass element i.e transistor for example

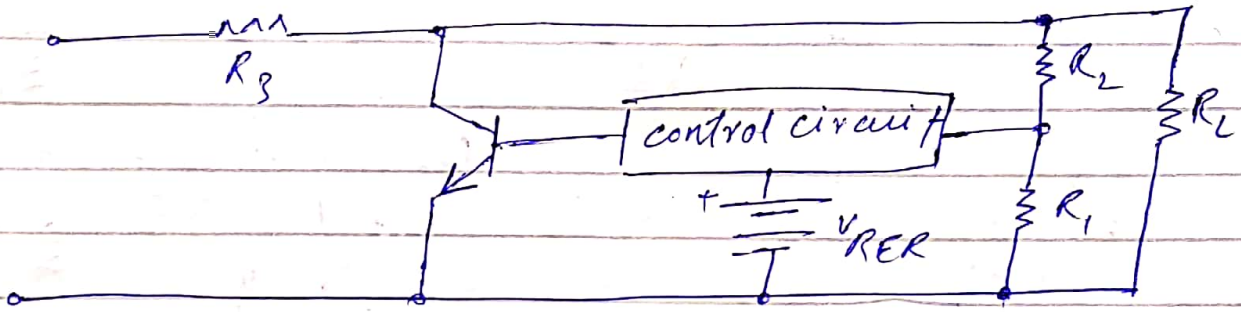
is connected in series with the load, then it is known as a series voltage regulators.



In this circuit, the output voltage of the regulator is sensed through the voltage divider network R_1 and R_2. This voltage is compared to reference voltage V_{REF}. The resulting error signal will control the conduction of the pass transistor. As a result, the voltage across the transistor is varied and the output voltage across the load is essentially maintained constant.

→ **Shunt voltage Regulators:-** A shunt voltage regulator is contrast to a series voltage regulator. If the pass transistor in the linear voltage regulator

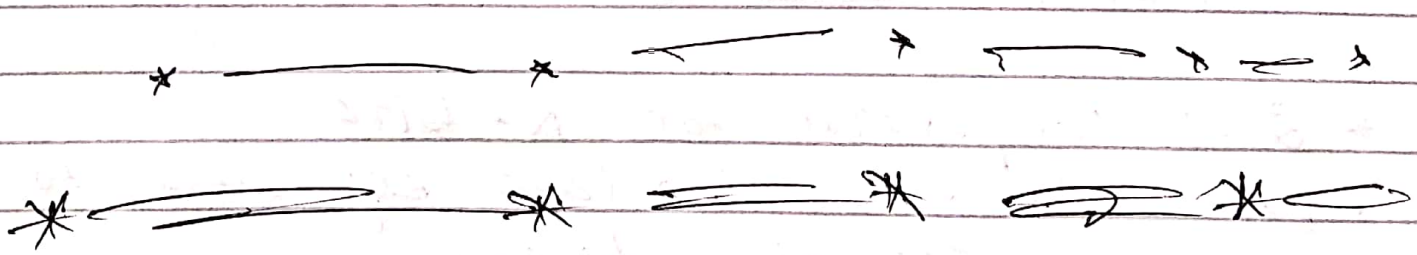
is connected in parallel to the load, then the regulator is known as a Shunt voltage regulators.



In this circuit, the conduction of the transistor is controlled based on the feedback and reference voltage such that the current through the series resistor remains constant. As the current through transistor varied, the voltage across the load remain essentially constant.
When compared to series regulators, shunt regulators are slightly less efficient but have a simpler implementation.

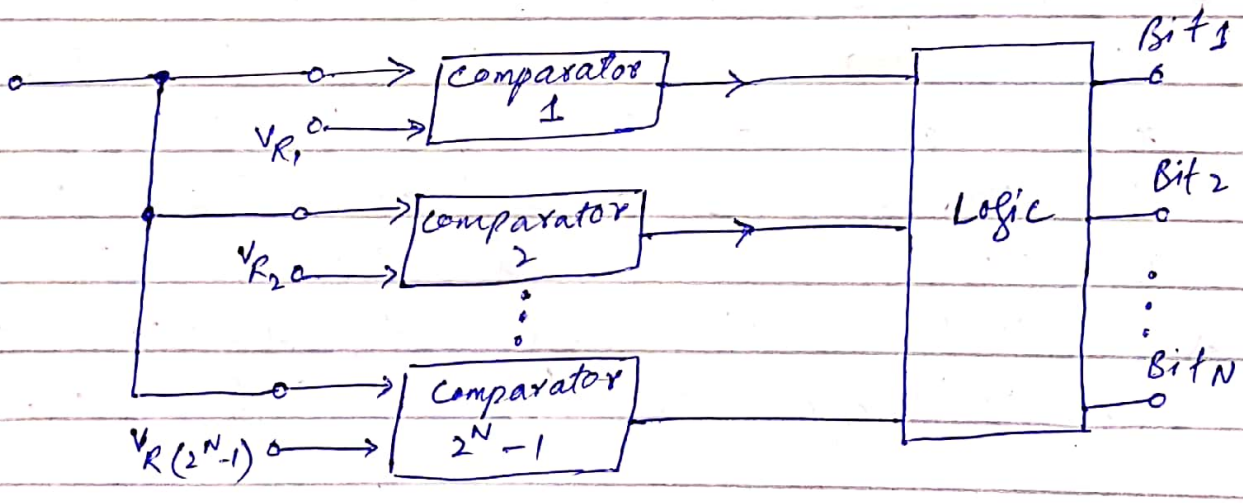
(2)→ Switching voltage Regulator :-
The switching voltage regulator is a type of regulator in which efficient transfer of power to the load is greater than series and shunt regulator because the transistor is not always conducting.

* The switching regulator passes voltage to the load in pulses, which is then filtered to provide as smooth dc voltage.
* The switching regulator is more efficient than the linear series or shunt type.
* This type of regulator is ideal for high current applications since less power is dissipated.
* voltage regulation in a switching regulator is achieved by the on and off action limiting the amount of current flow based on the varying line and load conditions.
* With switching regulator, 90% efficiency can be achieved.



Q:-4 Explain the working of Flash ADC.

Ans:- As the analog input voltage exceeds the reference voltage at each comparator, the comparator outputs will sequentially saturate to a high state.
The priority encoder generates a binary number based on the highest-order active input, ignoring all other active inputs.



* $2^N - 1$ comparator for N-bits
* Each reference voltage equivalent to a quantization level.
* Encoding logic produces word.

Q:-5 Differentiate between the following,
(a) Low pass & high pass filters.

Low pass	high pass
(1) It is used for smoothing the image	It is used for sharpening the image.
(2) It attenuates the high frequency	It attenuates the low frequency.
(3) Low frequency is preserved in it	High frequency is preserved in it.
(4) It allows the frequency below cut off frequency to pass through it.	It allows the frequencies above cut off frequency to pass through it.
(5) It consists of resistor that is followed by capacitor	It consists of capacitor that is followed by a resistor.
(6) It helps in removal of aliasing effect	It helps in removal of Noise.
(7) $G(u,v) = H(u,v) \cdot F(u,v)$	$H(u,v) = 1 - H'(u,v)$
(8) A low pass filters allows frequencies lower than its corner frequency to pass through it cleanly while blocking high frequency	A high pass filters allows frequencies higher than its corner frequency to pass through it cleanly while blocking low frequency.

(b) Active and passive filters.

Ans:-

(1) Due to the presence of active components, Active filters are expensive. However, the low cost of passive filters is the result of the presence of passive components in it.

(2) The circuit orientation of active filters is quite complex. while comparatively passive filters have a less complex circuit.

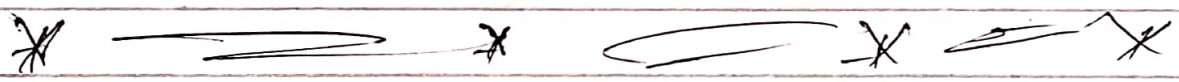
(3) Active filters possess a high value of quality factor as compared to passive filters.

(4) Active filters need an external supply of power for circuit operation. But passive filters do not require external energy source because it drives the energy for its operation from the applied input signal.

(5) As inductor is the basic component used in passive filters and it generates problems at low frequencies. Thus passive filters are suitable for RF Range operation. While Active filters provide a better response at low frequency.

(6) The weight of active filters is low while it is comparatively high for passive filters.

(7) Active components show greater sensitivity towards temperature changes. However, passive components are comparatively less sensitive towards the same.



The END