Department of Electrical Engineering
Assignment
Date: 24/06/2020

Course Details

Course Title: Electronic Circuit Design **Module:** 04
Instructor: _____ **Total Marks:** 50

Student Details

Name: _____ **Student ID:** _____

Q1.	(a)	**Discuss** the darlington connection for multistage amplifiers.	Marks 05+10
	(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	CLO 2
Q2.		**Explain** Colpitts and Hartley oscillators.	Marks 10
			CLO 2
Q3.	(a)	**Describe** the idea behind class B amplifiers.	Marks 06+06
	(b)	**Explain the** types of voltage regulators and their purposes.	CLO 2
Q4.		**Explain** the working of Flash ADC.	Marks 05
			CLO 2
Q5.		**Differentiate** between the following:	Marks 04+04
	(a)	Low pass & high pass filters	
	(b)	Active and passive filters	CLO 2

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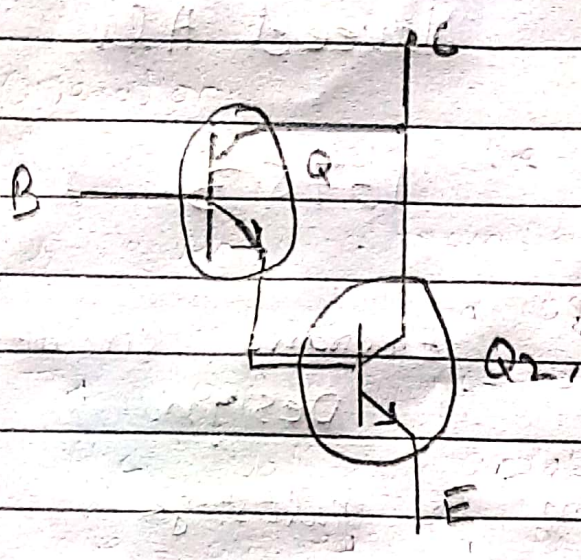
Subject: Electronic Circuit Design.

Darlington connection for multistage amplifier's.

A very popular connection of two bipolar Junction transistors for operation as one "superbeta" transistor is Darlington connection. The main Feature of darlington connection is that the composite transistor acts as a ~~signal~~ single unit with a current gain that is the product of current gain of the individual transistor. if the connection is made using two separate transistor having current gain of β_1 and β_2 the Darlington connection provides a current gain of $\beta_0 = \beta_1 \beta_2$.



Circuit diagram of darlington connection of multistage Amplifier's.

— X — X — X —

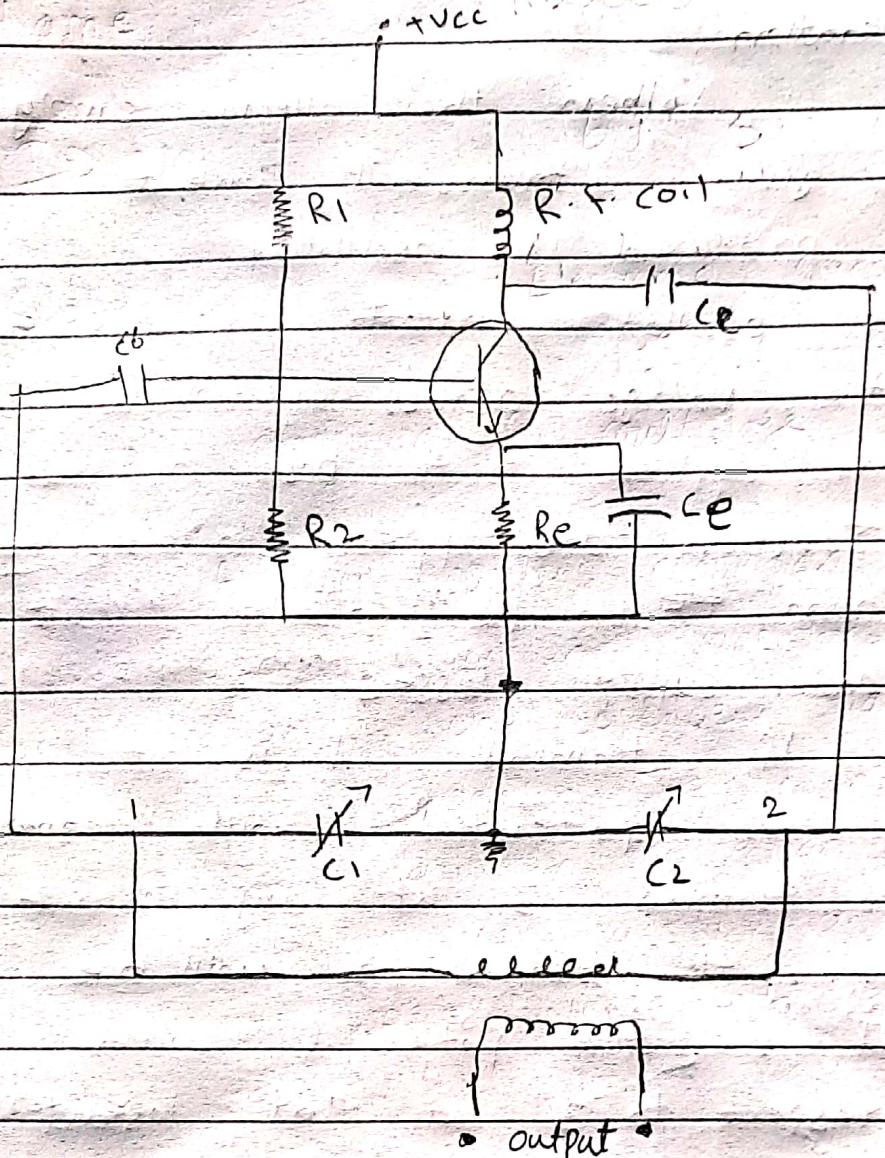
Q2:

Colpitts Oscillators:

A colpitts oscillators look like the Hartley oscillator but the inductors and capacitors are replaced with each other.

Construction.

Let us first take a look of circuit diagram of colpitts oscillator.



The resistor R_1, R_2 & R_e provide necessary biase condition for the circuit. The capacitor C_e provides a.c ground thereby providing an signal degeneration.

The capacitor C_c and C_b are employed to block dc. and provide an ac path.

Operation.

When the collector supply is given, a transient current is produced in oscillator. The oscillator ~~current~~ circuit produce Ac voltage across C_1, which are applied to the base emitter Junction and appear in amplified from ~~the~~ in the collector circuit and supply losses.

If terminal 1 is at positive potential with respect to terminal 3 at any instant then the terminal 2 will be at negative potential with respect to 3 at that instant because terminal 3 is ground.

Therefore. points 1 and 2 are out of phase by 180°.

Frequency.

The equation for frequency of colpitts oscillator is given as.

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

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

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

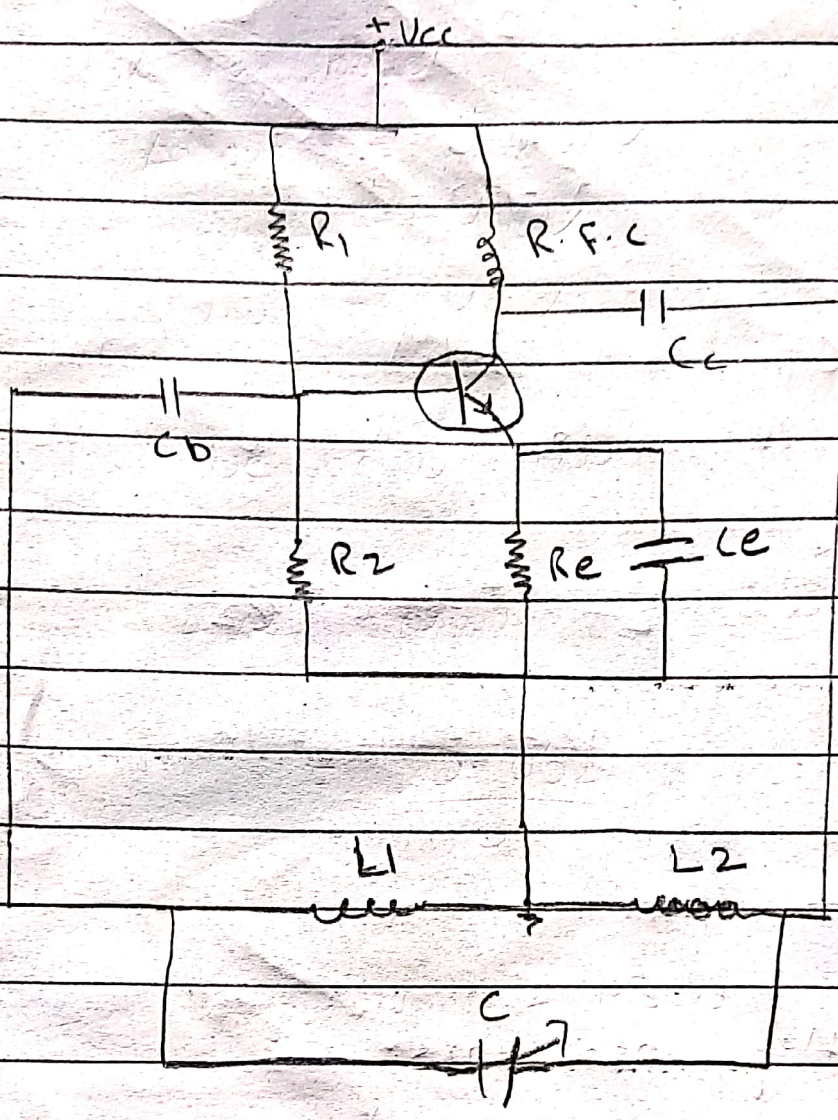
$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$$

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

Hartley oscillators.

A very popular local oscillators circuit that is mostly used in Radio receivers is the Hartley Oscillator's. The construction & operation of Hartley oscillators are given ~~bell~~ below.

Construction



In this circuit diagram of a Hartley oscillator. the resistors R1, R2 and Re provide necessary bias condition for the circuit.

The capacitor Ce provides ac ground thereby providing any signal deforation.

The capacitor Cc and Cb are employed to block dc and

provide an ac path.

Operation.

When the collector supply is given a transient current produced in oscillatory. The oscillators ~~current~~ circuit produces a ac voltage across LT. The auto-transformer made by the inductive coupling L1 and L2 help in determing the frequency.

Frequency.

The equation of frequency of Hartley oscillator is given.

$$f = \frac{1}{2\pi\sqrt{L_T C}}$$

$$f = \frac{1}{2\pi L_T C}$$

$$L_T = L_1 + L_2 + 2M$$

$$L_T = L_1 + L_2 + 2M.$$

Q1 (b)

Sol:- Given data.

$\Delta V_{out} = 0.062V$

$\Delta V_{in} = 4.5V$.

$V_{out} = 40V$.

As we know that:

$$\text{Line Regulation} = \frac{\Delta V_{out}}{\Delta V_{in}} \times 100$$

$$= \frac{0.062}{4.5} \times 100$$

Line Regulation = 1.3 %.

Now

$$\text{line Regulation} = \frac{(\Delta V_{out}/V_{out})}{\Delta V_{in}} \times 100\%$$

$$= \left(\frac{0.062}{40/4.5}\right) \times 100$$

Line Regulation = 0.0344 %/V

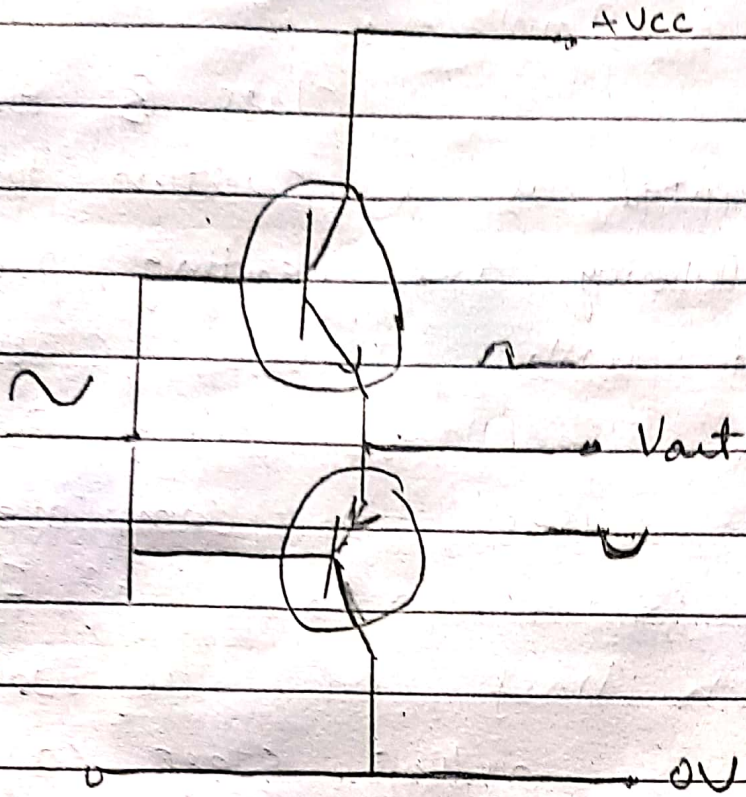
Q3. A)

Class B Amplifier:

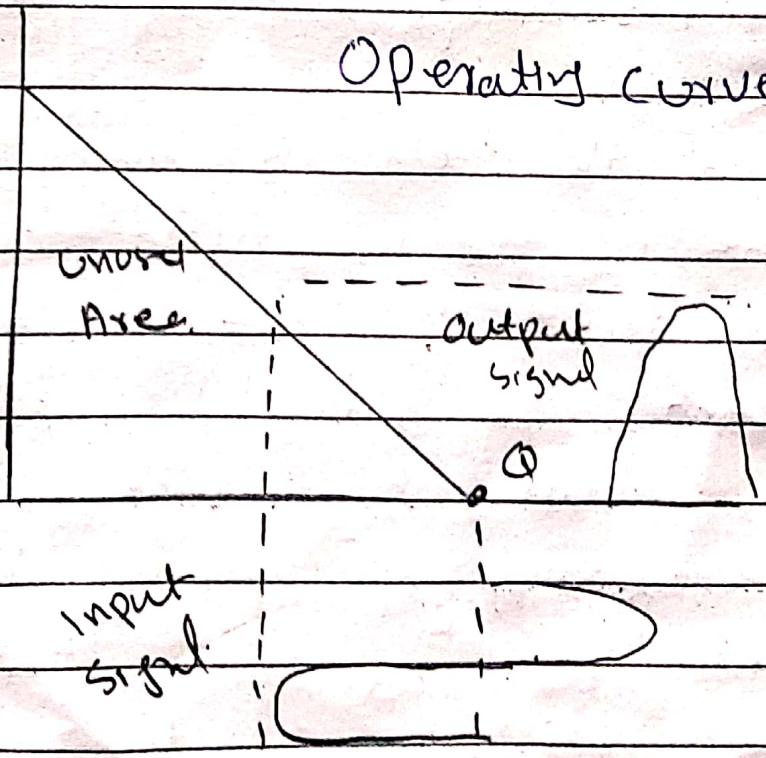
Class B Amplifier were invented as a solution to the efficiency and heating problems associated with previous Class A. Amplifier. The basic class B amplifier uses two complimentary transistor either bipolar of FET for each half of the waveform with its output stage configured in a "push-pull" type arrangement. So, that each transistor device amplifies only half of the output waveform.

In the class B amplifier, there is no DC biase current as its quiescent current is zero. So that DC Power is small & therefore its efficiency is much higher that of the class A. amplifer. However the price paid for the Improvement in the efficiency is the linearity of the switching device.

Circuit Diagram



Operating Curve.



When the input signal goes positive the positive biased transistor conducts while the negative transistor is switched off'
When the input signal goes negative the positive transistor switches 'off' while negative biased transistor turns 'ON' and conducts the negative portion of the signal.
Thus the transistor conducts only half of the time. either positive or negative half cycle of the input signal.

Q3
(b)

Different types of voltage regulator.

Voltage regulator are integrated circuits designed to regulate the voltage at their input to constant, fixed voltage at their output, irrespective of changes

in load current or input voltage.

Types of Regulator:

There are two types of voltage regulators

1. Linear voltage Regulators
2. Switching voltage Regulators

1. Linear ~~voltage~~ voltage Regulator.

Linear ~~voltage~~ voltage regulator use the principles of voltage divider to transform the voltage at their input to the desired voltage at their output.

Typical implementation of Linear voltage regulator involve the use of FET as on side of voltage divider with feedback loop connected to the gate transistor.

driving it as required to ensure consistency in the output voltage.
While this use of transistor as resistors help simplify the ~~design~~ design & implementation of Liner regulators. its contribute largely to the inefficiency associated with the regulator's.

2. Switching Voltage regulator's.
Although they feature a more complex design & require more companion components to function. switching voltage regulator are super-efficient regulators used in scenario's where power loss as in the liner regulators cannot be condoned.
The voltage regulation mechanism in ~~out~~ switching voltage regulator, involves rapidly switching an element connected in series with an

energy storage component (Capacitor or Inductor) to periodically interrupt the flow of transform the voltage from one value to other.

Unlike in liner voltage regulator, the switching element is either in fully conducting or switched-off state. It dissipate no power and allows the regulator to attain high level of efficiency beyond that of the liner regulator's.

— x — x — x —

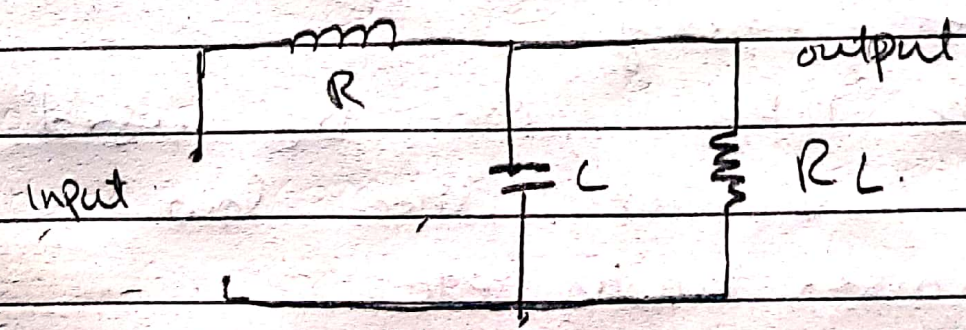
Q5. Difference between Low pass & high pass filter.

(A)

Low pass filter's.

① LPF circuit allows the frequency underneath cut off frequency for flowing through it.

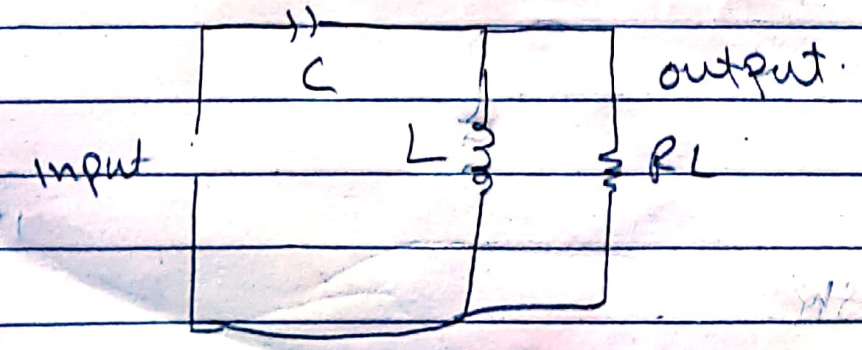
* It can be built with a resistor which is followed by a capacitor.
* It is important in eliminating the aliasing effect.
* It is lesser than the cut-off frequency.
* The LPF can be used as anti-aliasing filter in communication circuits.



Circuit diagram of Low pass filters.

High pass Filter.

* HPF circuit allows the frequencies over cut-off frequency for flowing through it.
* It can be built with a capacitor which is followed by a resistor.
* It is important whenever the distortion occurs because of low frequency signal like noise is ~~not~~ to be detected.
* It is high then cutt off ~~for~~ frequency.
* The HPF can be used in amplifier like low noise, audio, etc.



Circuit diagram of high pass filter.

Q5
(b) Active filter's.

* Active filters need outside source for their operation.
* Active filters have capability of amplifying filter output.
* Active filters are costlier than passive filter due to extra added active element & extend power required to operate an active element.
* Active filter have bandwidth limitation due to involvement of active element, which operate propurly in only specific frequency ranges.

Passive filter's

* Passive filter's do not need any outside source for their operton.
* Passive filters consume the power of input signal & cannot amplify the output signal.
* passive filter' are designed using capacitor's resistors & Inductors.

4 Due to the involvement of fewer elements passive filter are less complex & easy to design as compared to equivalent active filters.

— x — x — x — x —

Q4. Working of flash ADC.

The flash ADC also called parallel ADC. is very easy to understend. Its work by comparing the input voltge. i.e. the analog signal - to a reference voltge. which would be the maximum value achieved by the analog signal. for example.

if the reference voltge is of 5 volts this ~~mean~~ means that the peak of analog signal would be 5 volts.

on an 8- bit ADC when the input signal reached 5 volts we would find

a 255 (11111111) value on the ADC output. i.e the maximum value possible.

Then the voltage refence is lowered through a resister network and other comparator added. So the input voltge (analog signal) can be compared to the other values.

— x — x — x — x —