UNIT – I

PART – A

1 .What is biasing?[June 2013]

Biasing means switching on the transistor by external means or by applying dc voltages to establish a fixed level of current and voltage.

2. What are the types of biasing?

1. fixed bias 2. self bias 3. base bias 4. base bias with emitter feedback 5. base bias with collector feedback.

3. Define DC load line.

It is a line drawn on the output characteristics of a transistor circuit which gives the values of Ic & Vce when no input signal is given under dc conditions.

4. Define quiescent point.[NOV 2013]

It is a point on the dc load line which gives the values of Ic & Vce when no signal is applied.

5. Define AC load line.

It is a line drawn on the output characteristics of a transistor circuit which gives the values of Ic & Vce when input signal is given under AC conditions.

6. Define stability factor.

It is defined as the rate of change of collector current with repect to reverse saturation current.

7. Why voltage divider bias is preferred over other types of biasing ?

This biasing is always preferred because the stability of the Q point is maintained constant.

8. Which biasing is called as universal bias stabilization?

Voltage Divider Bias.

9. Define Stabililty.[NOV 2013]

The stability of a system is a measure of the sensitivity of a network to variations in its parameters.

10.What are the parameters that affect the stability .

Change in β , Vbe , Ico.

11.Define stability factor w.r.t β , Vbe , Ico .

$S(Ico) = \Delta Ic / \Delta Ico$, $S(Vbe) = \Delta Ic / \Delta Vbe$, $S(\beta) = \Delta Ic / \Delta \beta$

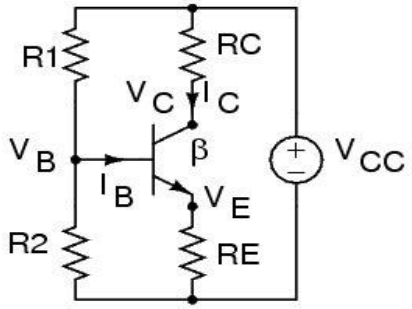
12. Write the difference between FET & BJT .

BJT	FET
There will be linear relationship between input and output	There is a non linear relationship between input and output
The input is controlled by current	The input is controlled by voltage

13. Write the types of FET biasing.

1. Fixed biasing 2. Self bias 3. Voltage divider bias.

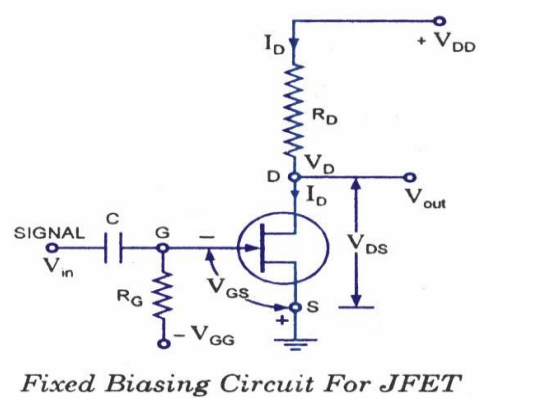
14. Draw the circuit of self bias using BJT.



15. What is the need for compensation technique?

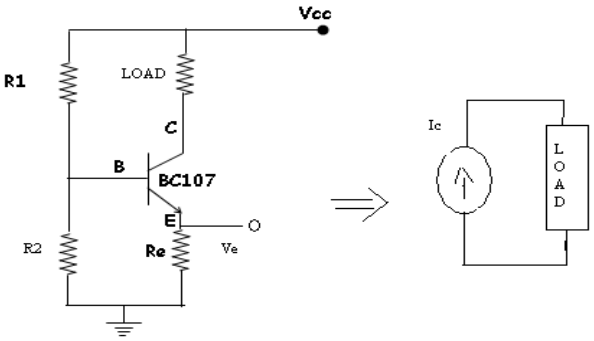
Due to negative feedback the gain of the amplifier is reduced. To overcome this compensation technique is used

16.Draw the circuit of fixed bias using FET.



Fixed Biasing Circuit For JFET

.17.Draw the constant current circuit .



18. Write the conditions of thermal stability[June 2013]

The required condition to avoid thermal runaway is that the rate at which heat is released at the collector junction must not exceed the rate at which the heat can be dissipated.

$$\frac{\partial P_C}{\partial T_j} < \frac{\partial P_D}{\partial T_j}$$

19.Write the general expression for stability factor.

$S = 1+\beta / 1- \beta * dI_B / dIc$

20.Write the application of JFET.

It is used as VVR. It is used in high impedence amplifier.

21.What is the advantage of using emitter resistance in the context of biasing?

Emitter resistance increases stability by negative feedback. Hence it is used.

22.List out the biasing methods of MOSFET.

Drain feedback bias ,Self bias

23. What are the advantage and disadvantage of fixed bias?

Advantage: This circuit is very simple as it requires only onje resistor and the calculations are easy. **Disadvantage**: It provides poor stabilization.

24.What are the parameters that define the Q point of BJT?

Collector to emitter voltage VCE and Collector current Ic.

25. What are the disadvantage of base bias with collector feedback?

This circuit does not provide good stabilization. This circuit provides negative feedback which reduces the gain of the amplifier.

PART – B

1.Explain about fixed bias of BJT and derive the expression for stability factor .

2.Explain about voltage divider bias of BJT and derive the expression for stability factor.[NOV 2013]

3.Explain about the compensation technique to stabilize Q point using diode and thermistor.

4.Write the factors that affect the stability of Q point and explain how self bias circuit acts as a constant current circuit?

5.Explain about source self bias of FET and derive the expression for stability factor .

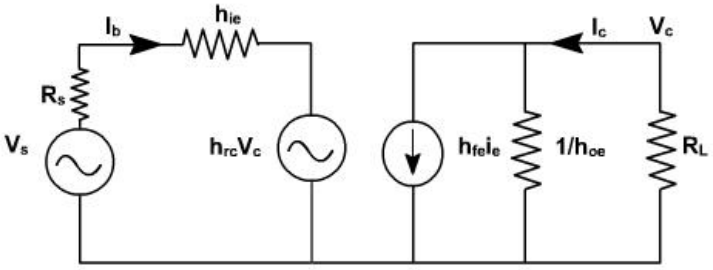
6.Explain about voltage divider bias of FET and derive the expression for stability factor.
7.What is the need for biasing? Define DC and AC load line. Explain how JFET acts as a VVR.
8.Design a collector to base bias circuit for Vcc =15V, Vce =5V, Ic = 5mA,hfe = 100.
9.A transistor with β = 50, Vbe = 0.7V, Vcc = 22.5V & Rc = 5.6K is used in a biasing circuit. It is designed to establish the quiescent point at Vce = 12V, Ic = 1.5mA, S = 3. Find the values of RE, R1 & R2.
10.i) A self biased P-Channel JFET has a pinch off voltage =%V and Idss = 12mA. The supply voltage available is 12V. Determine the values of resistors R_D and R_S so that I_D = 5mA and Vds = 6V.
ii) Calculate the self bias operation point for the FET circuit . Also calculate the values of resistors R_D and R_S to obtain the bias condition. Given the maximum value of drain current as 10 mA and Vgs = -2.2V at I_D = 5mA
11.Explain thermistor and sensistor compensation technique.
12.Explain the biasing technique of enhancement type MOSFET.[NOV 2013]
13. Explain the biasing technique of depletion type MOSFET.

UNIT – II
PART – A

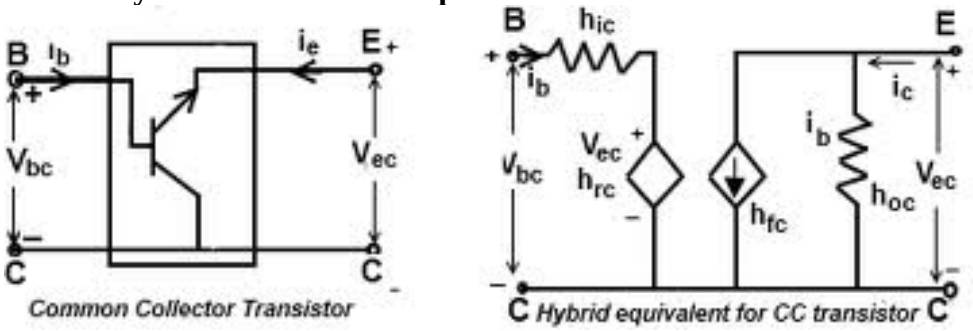
1.Write the procedure to draw the a.c. equivalent of a network.

i. Setting all the dc sources to zero and replacing them by a short circuit equivalent.
ii.Replacing all capacitors by a short circuit.
iii.Removing all elements bypassed by the short circuit equivalents introduced by step 1 & step 2.
iv.Redrawing the n/w in a more convenient & logical form.

2.Draw the hybrid model of CE amplifier.



3. Draw the hybrid model of CC amplifier.



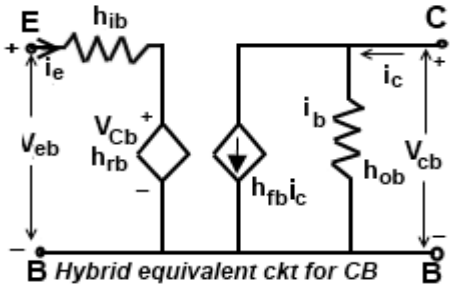
4.Write the hybrid equations of CE amplifier.

Vb = hie ib + hre Vc
Ic = hfe ib + hoe Vc

5.Write the hybrid equations of CB amplifier.

Ve = hib ie + hrb Vc
Ic = hfb ie + hob Vc

6.. Draw the hybrid model of CB amplifier.



Hybrid equivalent ckt for CB

7.Write the hybrid equations of CC amplifier.

Vb = hic ib + hrc Ve

Ic = hfe ib + hoc Ve

8.What is meant by hybrid parameters?

The Parameters which has the combination of different units are called hybrid parameters.

9.Define millers theorem.

It states that the capacitance which connects the input and output of the circuit is split into input miller capacitance Ci and output miller capacitance Co.

10.Write the uses of CE amplifier.

i. It is used as phase inverter.

ii. It is used as voltage amplifier.

11.Write the characteristics of CB amplifier.

i.Input impedence is low.

ii.Output impedence is high

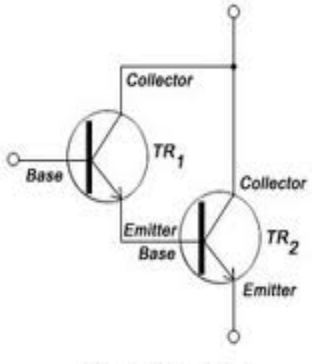
iii.Current gain is less than unity.

iv.High voltage gain.

12.What is bootstrapping.

Bootstrapping is the technique by which the change in voltage in one end of the resistor causes the same change in voltage in the other end also.

13.Draw the symbol for Darlington transistor.[June 2013]



14.Define CMRR.

It is the ratio of differential mode voltage gain to the common mode voltage gain.

15.Define bisection theorem.

Any network which has a mirror symmetry at the imaginary line, then that can be split into two equal networks.

16.What is a differential amplifier?

An amplifier which amplifies the difference between the two inputs are called differential amplifier.

17.Why constant current source biasing is preferred for differential amplifier ?

The constant current source is preferred in order to increase the input resistance and to make the common mode gain zero.

18.What is difference mode signal?

When two separate signal inputs are applied to the operational amplifier, the resulting signal is the difference between two signals . This is called difference mode signal.

19.List the advantages of Darlington amplifier?[NOV 2013]

The main advantage of Darlington amplifier is very large increase in input impedence and an equal decrease in output

20.List the applications of differential amplifier.

i.Linear amplifier
ii.Limiter
iii.Amplitude modulator.

21.What are the limitations of h-parameters?

i. The h-parameters can subject to variation in temperature, so it is lightly difficult to compute accuracy.
ii.h-parameters can be used to analyze only the small signal amplifiers.

22.Why should a differential amplifier have a high CMRR?

In order to have output voltage free from common mode signal , the CMRR should be as large as possible.

23.Give the condition for Approximate analysis of small signal model.

Product of hoe. And $R_{L'}$ must be < 0.1.is the basic condition for Approximate analysis of small signal model.

24. What is the main application of CB configuration of transistor?

CB configuration is mainly used in high frequency switches and analyzing the switching model

25.Define millers theorem.

It states that the capacitance which connects the input and output of the circuit is split into input miller capacitance Ci and output miller capacitance Co.

PART – B

1.The hybrid parameters of a transistor used as an amplifier in the CE configuration are hie = 800Ω, hfe = 46, hoe = 80 x 10^{-6} and hre = 5.4x 10^{-4} . If RL = 5K and Rs = 500Ω.Calculate Ai, Ri , Av,Pi.

2.Explain about CE amplifier and derive the expression for h parameters of the same.

3. Explain about CB amplifier and derive the expression for h parameters of the same.

4. Explain about CC amplifier and derive the expression for h parameters of the same.

5.Derive the expression for gain , input impedence and output impedence of CC amplifier.

6. Derive the expression for gain , input impedence and output impedence of CE amplifier.

7. Derive the expression for gain , input impedence and output impedence of CB amplifier.

8.Explain about darlington amplifier and derive the expression for gain , input impedence and output impedence .

9.Explain differential amplifier and derive the expression for common mode gain and differential mode gain. [NOV 2013]

10.How to improve CMRR? Explain with a circuit. Write short notes on transfer characteristics of differential amplifier .[NOV 2013]

11.Explain about linear amplifier and amplitude modulator.

12.The differential amplifier has the following values Rc = 50K, Re = 100K and Rs = 10K. The transistor parameters are $r_{\pi = 50K=}$ hie. hfe = Vo = 2 x10^3, ro = 400K.Determine Ad, Ac and CMRR in db.

UNIT – III

PART – A

1.Define BiMOS amplifier.

An amplifier whose input stage is MOSFET differential amplifier and the rest of the circuit uses BJT is called BIMOS amplifier.Since it uses both BJT and MOSFET ,it is called BIMOS.It is implemented in complementary MOS technology ,hence BIMOS is also called as BICMOS.

2.What is body effect in MOSFET?

The body effect occurs in MOSFET when the substrate is not tied with the source but it is tied with the negative power supply in the IC.

3.What are the two types of signal swing?

1.Upswing 2.Down swing

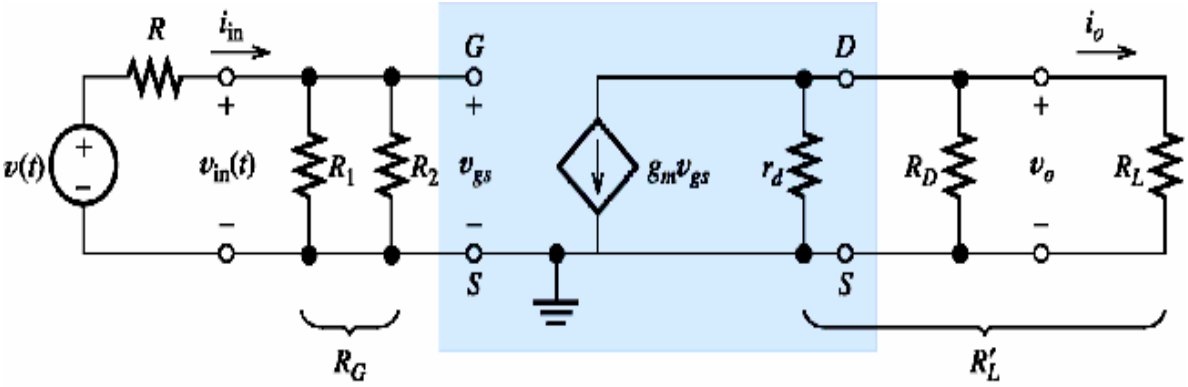
4.Write the characteristics of common source MOSFET amplifier.

Voltage gain is greater than unity , output resistance is moderate to high.

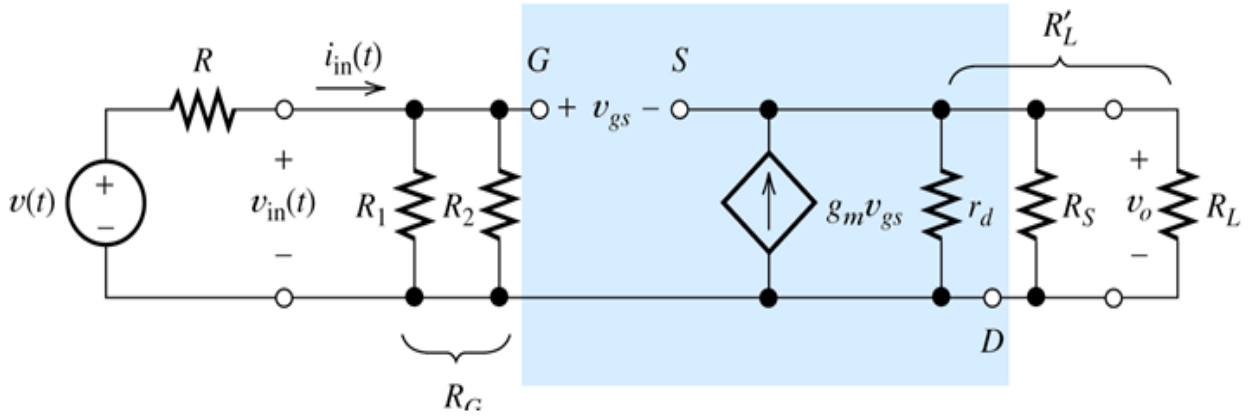
5.Write the characteristics of MOSFET source follower amplifier.

Voltage gain is equal to unity and output resistance is low.

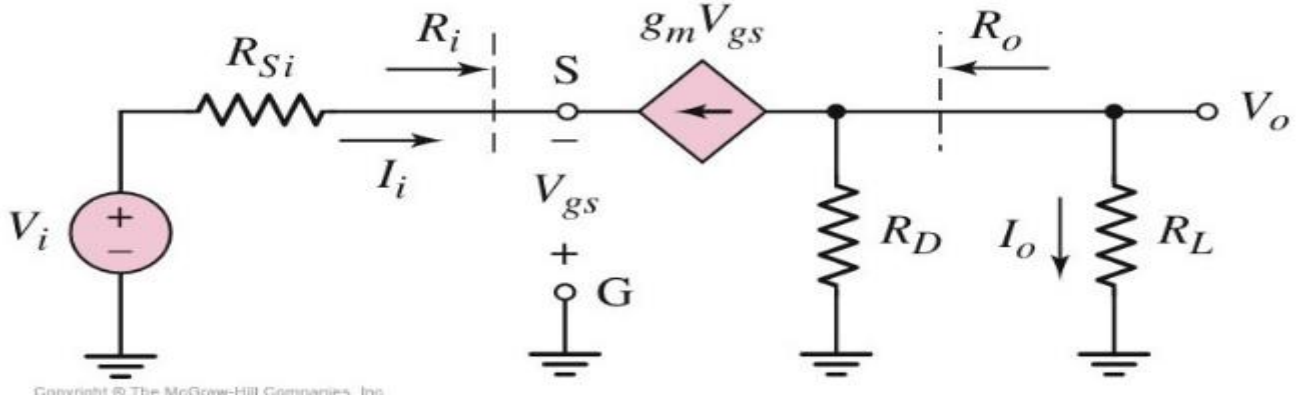
6.Draw the equivalent circuit of common source MOSFET amplifier.



7. Draw the equivalent circuit of source follower MOSFET amplifier.



8. Draw the equivalent circuit of common gate MOSFET amplifier.



9.Write the three FET parameters.

1.transconductance 2.Drain resistance 3. Amplification factor

10.Define transconductance.

It is the rate of change of drain current with gate voltage by keeing Vds constant.

$g_m = id / Vgs \mid_{Vds}$

11.Define drain resistance.

It is the rate of change of drain voltage to drain current by keeping gate to source voltage constant.

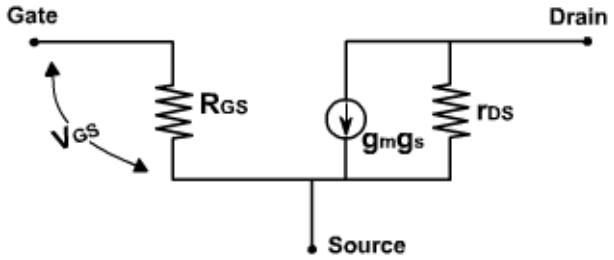
12.Define amplification factor.

It is the rate of change of drain voltage with gate voltage by keeping drain current constant.

13.What are the three types of MOSFET amplifiers?

Common source MOSFET amplifier, Common gate MOSFET amplifier and Common drain MOSFET amplifier

14. Draw the equivalent circuit of CS FET.



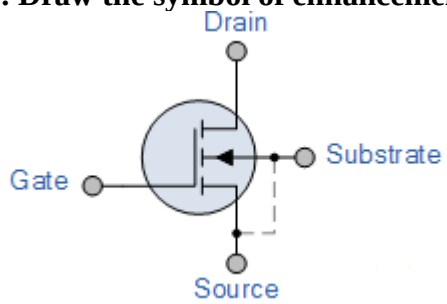
15.What do you mean by non unilateral amplifiers?

The internal feedback of the amplifier may cause the input resistance to depend on the value of the resistance of the signal source feeding the amplifier. Such an amplifier is called nonunilateral amplifiers.

16. What do you mean by unilateral amplifiers?

An amplifier whose internal feedback may cause their input resistance to depend on their load resistance. Such an amplifier is called unilateral amplifer.

17. Draw the symbol of enhancement mode n-MOSFET.



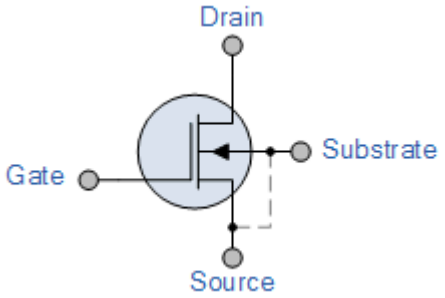
18.Define channel length modulation.

In MOSFET if V_{DS} is increased beyond Vds(sat) , it will affect the channel.If Vds is increased ,the channel pinch off is moved slightly away from the drain toward the source.The voltage across the drain remains constant and the additional voltage applied to the drain appears as a voltage drop across the narrow depletion region between the end of the channel and the drain region.This voltage accelerates the electron that reach the drain end of the channel and sweeps them across the depletion region into the drain. Now the channel length is reduced. This phenomenon is known as channel length modulation.

19.Define Pinch off Voltage?

The voltage at which the current flow between source and drain is blocked because the channel between these electrodes is completely depleted.

20. Draw the symbol of Depletion mode n-MOSFET?



PART-B

1. Explain about JFET CS amplifier and derive the expression for gain , input impedence and output impedence .
2. Explain about JFET CG amplifier and derive the expression for gain , input impedence and output Impedence.
3. Explain about JFET CD amplifier and derive the expression for gain , input impedence and output Impedence.
4. Explain about MOSFET CS amplifier and derive the expression for gain , input impedence and output impedence .
5. Explain about MOSFET CG amplifier and derive the expression for gain , input impedence and output impedence.
6. Explain about MOSFET CD amplifier and derive the expression for gain , input impedence and output impedence.
7. Explain the operation of BIMOS cascode amplifier with a neat diagram.
8. Difference between JFET and MOSFET?
9. Explain the small signal equivalent of MOSFET common source with and without resistance?
10. Explain the small signal equivalent of MOSFET common drain or source follower?

UNIT – IV

PART – A

1.State the reason for fall in gain at low and high frequencies.

The coupling capacitance has very high reactance at low frequency, therefore it will allow only a small part of signal from one stage and in addition to that the bypass capacitor cannot bypass the emitter resistor effectively. As a result of these factors the voltage gain rolls off at low frequency.

At high frequency the reactance of coupling capacitor is very low, therefore it behaves like a short circuit. As a result of this the loading effect of the next stage increases which reduces the voltage gain. Hence the voltage gain rolls off at high frequency.

2.Write short note on effects of coupling capacitor.

The coupling capacitor transmits a.c. signal but blocks d.c. This prevents d.c. interference between various stages and the shifting of operating point. It prevents the loading effect between adjacent stages.

3.Where do we use wide band amplifiers?

It is used in tuned amplifiers, amplitude modulators& video amplifiers

4.How to improve high frequency response of a single stage amplifier?

High frequency response can be improved by using hybrid pi model of the transistor.

5.Define unity gain frequency.

It is the frequency at which the short circuit current gain becomes unity.

6.What are cascade amplifiers?

It is an amplifier which has a number of stages in which all the stages are CE amplifiers.

7.What is a miller capacitance of a transistor?

In any equivalent circuit if the capacitor is connected between input and output, that can be split into two capacitor as Cmi & Cmo. These are called miller capacitance.

8.What is millers theorem?

Millers theorem states that the capacitor connected between the input and output can be split into input miller capacitance and output miller capacitance.

9.Define the frequencies f_T & $f\beta$

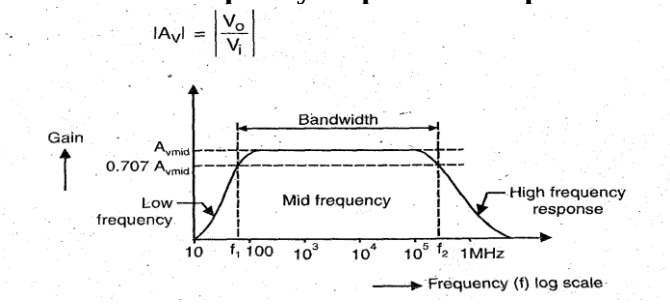
f_T – It is the frequency at which short circuit gain becomes unity.

$f\beta$ - It is the frequency at which short circuit gain becomes unity.

10.Define frequency response.

It is a response drawn between the frequency Vs gain of the amplifier.

11.Draw the frequency response of amplifiers.



12.What is multistage amplifier?

It is an amplifier which has more than one no. of stages to increase the gain of the amplifier.

13.Define bandwidth.

It is the difference between the upper cut off frequency and the lower cutoff frequency.

14.Write the disadvantage of RC coupled amplifier.

The circuit is complex.

The gain is reduced.

15.What is 3 db frequency?

The frequency at which we have 70.7% of fall from the maximum gain is called 3db frequency.

16.In an amplifier the maximum voltage gain is 2000, occurs at 2KHz. It falls to 1414 at 10Hz and 50Hz.Find i) B.W ii) Lower and upper cut off frequency.

B.W = 50Hz – 10Hz = 40Hz. F1 = 10Hz, F2 = 50Hz

17.A three stage amplifier has a first stage voltage gain of 100, second stage voltage gain is 200 & third stage gain of 400.Find the total voltage gain in db.

Gv = 20log10 100 + 20log10 200 + 20log10 400 = 82.9db

18. Define upper and lower cut off frequencies of an amplifier.

The frequency at which the voltage gain of the amplifier is exactly 70.7% of the maximum gain is known as lower cut off frequency.

The frequeny at which the voltage gain of the amplifier, is exactly 70.7% o0f the maximum gain is known as upper cutoff frequency.

19.Define the term bandwidth ?[NOV 2013]

Bandwidth is defined as the range of frequency over which the gain remains constant.

20.Define the term gain bandwidth product?

The product of midband gain and bandwidth is called gain bandwidth product .

PART – B

1. Explain about low frequency analysis of BJT and derive the expression for lower cut off frequency and also plot the graph.
2. Determine the effect of Cs, Cc & Ce on the low frequency response of BJT.
3. Explain about the high frequency response of BJT and derive the expression for upper cut off frequency and also plot the graph.
4. Explain about low frequency analysis of MOSFET and derive the expression for lower cut off frequency and upper cut off frequency.
5. Explain about the high frequency response of MOSFET and derive the expression for lower cut off frequency and upper cut off frequency.

6. What is multistage amplifier .Explain about the frequency response for multistage amplifier. Derive the expression for overall upper and lower cutoff frequency of the same.
7. Discuss the frequency response characteristics of RC coupled amplifier . Derive the expression for gain.
8. Explain about CS amplifier and derive the expression for gain , input impedance and output impedance .
9. Explain the effects and analysis of MOSFET internal capacitance?
10. Explain in detail about the Miller theorem and Miller effect?

UNIT V

PART - A

1. Comparsion of MOSFET and BJT?

	NMOS	NPN
Circuit symbols and physical structures	NMOS has symmetric structure for drain and source	NPN has asymmetric structure for collector and emitter
Current	current flows from drain to source	current flows from collector to emitter
Voltage	$v_D > v_S$, $v_G > v_S$	$v_B > v_E$, $v_C > v_E$

2. Define current steering?

Biasing in integrated-circuit design is based on the use of constant-current sources. On an IC chip with a number of amplifier stages, a constant dc current (called a reference current) is generated at one location and is then replicated at various other locations for biasing the various amplifier stages through a process known as current steering.

3.Define Current gain or Current transfer ratio of the current mirror?

Current gain of the current mirror is given by ratio between Output current(I_O) to the input reference current (I_R)

$$\frac{I_O}{I_{REF}} = \frac{(W|L)2}{(W|L)1}$$

4.Define Current Mirror?

A current mirror is a circuit designed to copy a current through one active device by controlling the current in another active device of a circuit, keeping the output current constant regardless of loading. The current mirror is used to provide bias currents and active loads to circuits

5.Write two type of schemes commonly **used for MOSFET scaling?**

1.Constant –Voltage Scaling 1.Constant-Field Scaling.

6.**Define constant field Scalling?**

In constant-field scaling, the MOSFET dimensions as well as supply voltages are scaled by the same scaling factor S, greater than 1.The scaling of supply and terminal voltage maintains the same electric field as that of original device; hence such scaling is termed constant-field scaling.

7.Define Transition Frequency (f_T)?

f_T is a measure of the ***intrinsic*** bandwidth of the transistor itself and does ***not*** take into account the effects of capacitive loads.

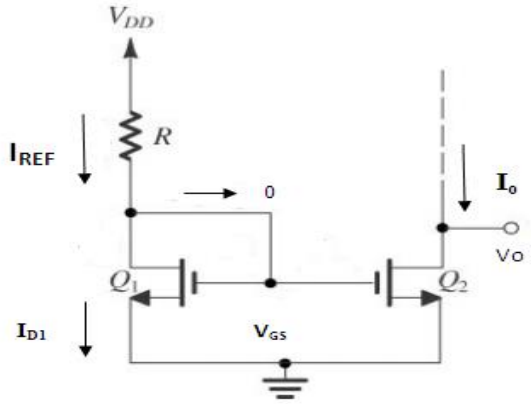
8.List out the effect of short channel MOSFET?

1. Drain induced barrier lowering (DIBL)2. Punch through effect3. Threshold voltage roll-off
4. Gate tunneling currents5. Hot carrier effect

9. Define Punch through effect?

We know that in short-channel devices, channel lengths are of the order of the source/drain depletion region thickness. When drain voltage is increased, the drain depletion region touches the source depletion region. This condition is known as the punch through effect.

10, Draw the basic MOSFET constant current source?

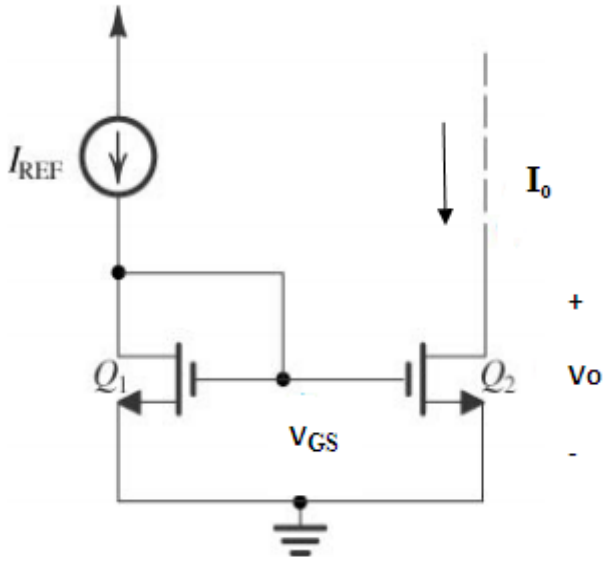


11.How does thebody effect change the small-signal equivalent circuit of the MOSFET?
The body effect changes the threshold voltage, which in turn affects the drain current

12.What is Body effect?

The threshold volatge V_T is not a constant w. r. to the voltage difference between the substrate and the source of MOS transistor. This effect is called substrate-bias effect or Body effect

13,Draw the basic MOSFET constant current mirror?



14..Define Threshold voltage in CMOS?

The Threshold voltage, VT for a MOS transistor can be defined as the voltage appliedbetween the gate and the source of the MOS transistor below which the drain tosource current, IDS effectively drops to zero

15.Define Short Channel devices?

Transistors with Channel length less than 3- 5 microns are termed as Short channeldevices. With short channel devices the ratio between the lateral & vertical dimensionsare reduced.(a) Non-Saturated Region(b) Saturated Region

16.Difference between PMOS and NMOS?

NMOS (n-type MOS transistor)

(1) Majority carrier = electrons
(2) A positive voltage applied on the gate with respect to the substrate enhances the number of electrons in the channel and hence increases the conductivity of the channel.
(3) If gate voltage is less than a threshold voltage Vt , the channel is cut-off (very low current between source & drain).

PMOS (p-type MOS transistor)

(1) Majority carrier = holes

(2) Applied voltage is negative with respect to substrate

17. Why NMOS technology is preferred more than PMOS technology?

N-channel transistors have greater switching speed when compared to PMOS transistors. Hence, NMOS is preferred than PMOS.

18. Compare between CMOS and bipolar technologies ?

S.no	CMOS	Bipolar Technology
1	High Input impedance(Low drive current)	Low Input Impedance(High drive current)
2	High packing density	Low packing density
3	Bidirectional Capability	Essentially unidirectional

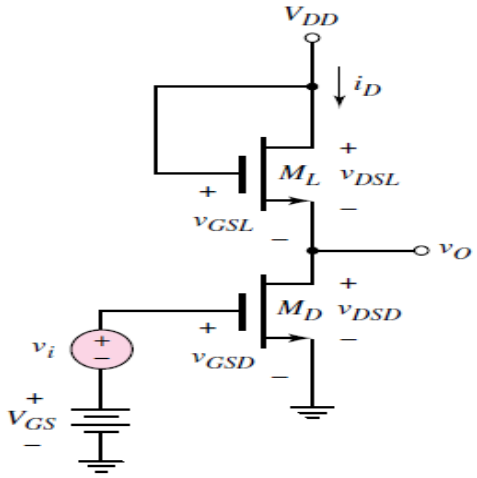
19. List out the advantages of CMOS?

1, Low power.2, Fully restored logic levels.3, Rise and fall transition times are of the same order 4, Very high levels of integration.4,High performance.

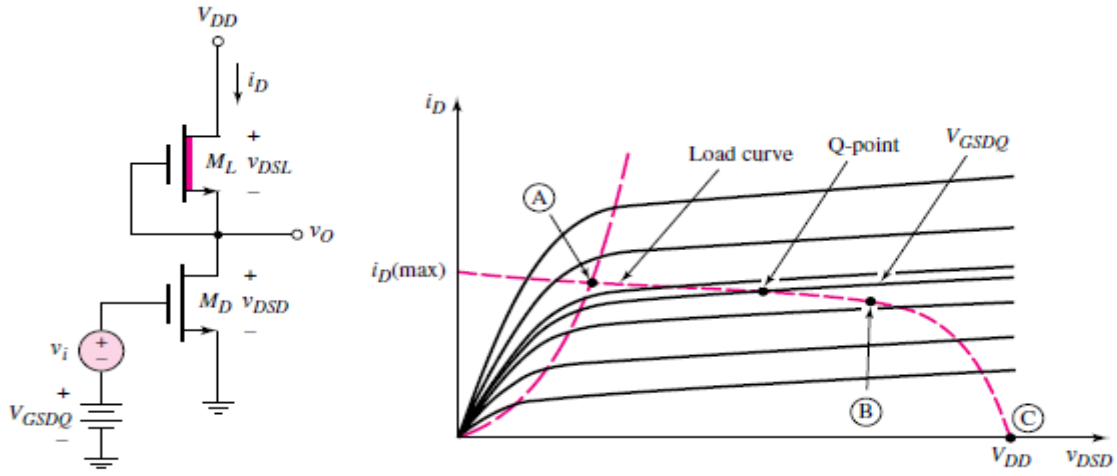
20. Discuss the physical meaning the small signal circuit parameter r_o?

The output resistance for MOSFET device is determined by r_o being the ratio of Early voltage (V_a)to the bias current Id.ro is inversely proportional to bias current.

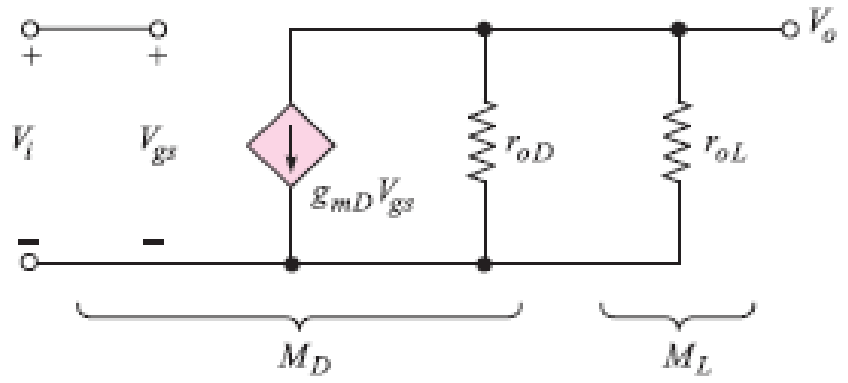
21. Sketch the NMOS amplifier with enhancement load?



22. Sketch the NMOS amplifier with depletion load & V-I charterstics ?



23. Draw the small signal equivalent circuit for NMOS Invertor with depletion load?



M_D=Driver Transistor
M_L=Load Transistor

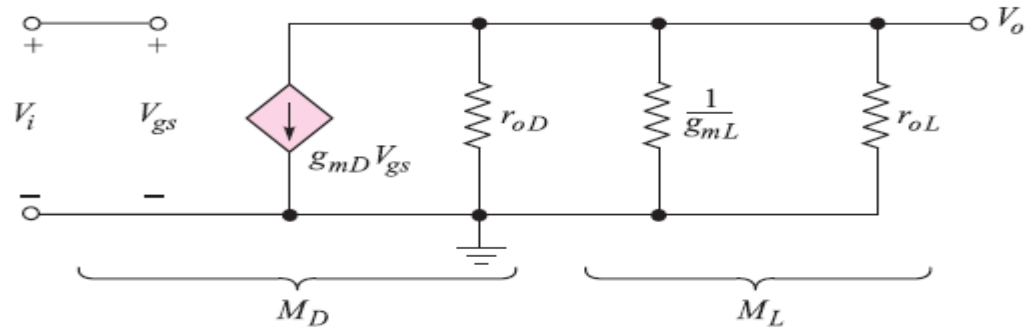
24. Features of CMOS source follower?

1. Voltage gain close to unity, 2.Used as voltage buffers, 3. Can provide current gain

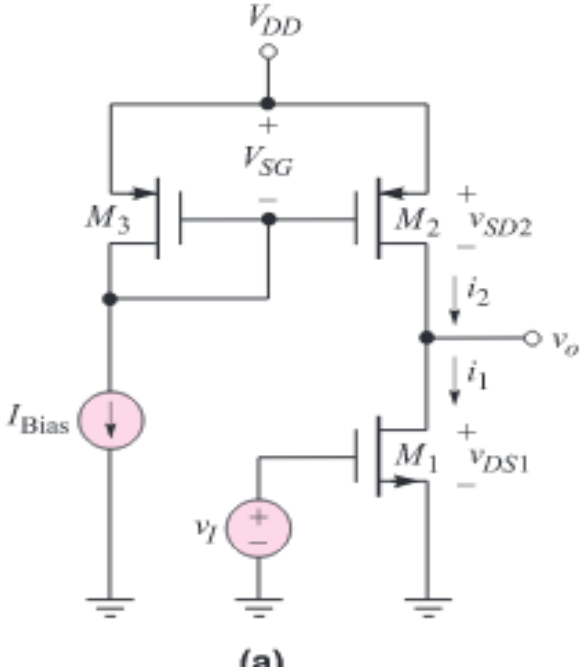
25. Features of CMOS source follower?

1. Voltage gain close to unity, 2.Used as voltage buffers, 3. Can provide current gain

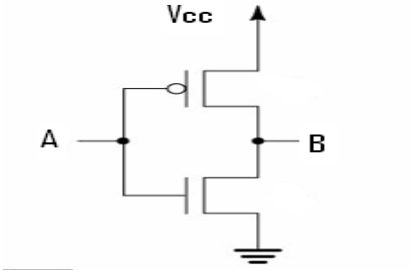
26. Draw the small signal equivalent circuit for NMOS Invertor with Enhancement load?



28. Sketch the CMOS Common source amplifier?



27. Sketch the CMOS inverter?



PART – B

1. Describe the operation of the NMOS amplifier with an Enhancement load?
2. Describe the operation of the NMOS amplifier with an depletion load?
3. Describe the operation of the NMOS amplifier with an PMOS load?
4. Explain CMOS differential amplifier and with CMRR?
5. Write short notes on MOS Current steering Circuits? Explain with circuit?
6. Describe the working principle of Basic MOSFET current source circuit with neat circuit?
7. Describe the working principle of Basic MOSFET current mirror circuit with neat circuit?
8. Explain the circuit principle of CMOS common source amplifier circuit?
9. Explain the circuit principle of CMOS source follower amplifier circuit ?
10. Compare the difference of NMOS depletion load,NMOS enhancement load &CMOS invertor?