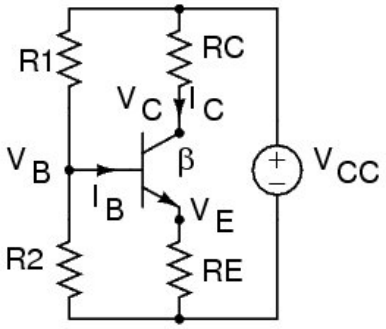
UNIT – I BIASING OF DISCRETE BJT AND MOSFET
PART – A

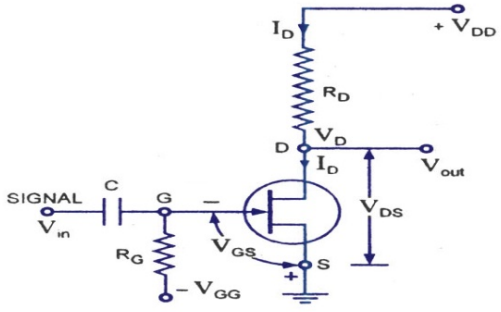
1. **What are the types of biasing**.
   1. fixed bias 2. self bias 3. base bias 4. base bias with emitter feedback 5. base bias with collector feedback.
2. **Define DC load line.**
   It is a line drawn on the output characteristics of a transistor circuit which gives the values of Ic & Vce when no input signal is given under dc conditions.
3. **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.
4. **Define stability factor.**
   It is defined as the rate of change of collector current with respect to reverse saturation current.
5. **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.
6. **What is need for biasing in transistor amplifier?**
   When a transistor is biased properly, it works efficiently and produces no distortion in the output signal and thus operating point can be maintained stable.
7. **Define Stabililty.**
   The stability of a system is a measure of the sensitivity of a network to variations in its parameters.
8. **Define stability factor w.r.t β , Vbe , Ico .**
   $S(Ico) = \Delta Ic / \Delta Ico$, $S(Vbe) = \Delta Ic / \Delta Vbe$,$S(\beta) = \Delta Ic / \Delta \beta$
9. **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
Based of the both electrons and holes	Based on majority carriers

10. **Write the types of FET biasing.**
    1. Fixed biasing 2. Self bias 3. Voltage divider bias.
11. **Draw the circuit of self bias using BJT.**

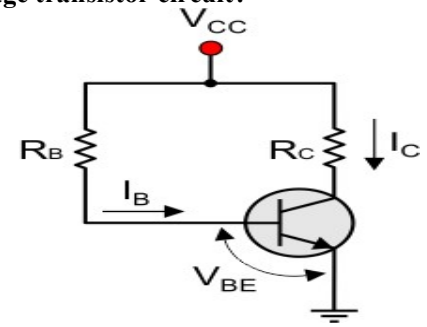


12. **What is the need for compensation technique?**
    Due to negative feedback the gain of the amplifier is reduced. To overcome this compensation Technique is used.
13. **Draw the circuit of fixed bias using FET.**

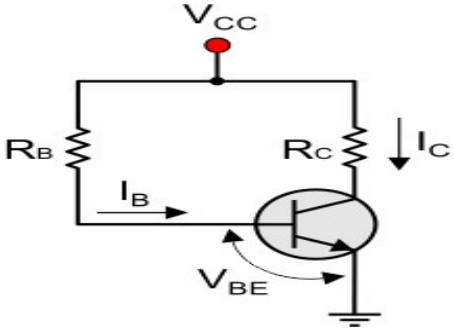


Fixed Biasing Circuit For JFET

14. Draw the Fixed bias single stage transistor circuit?



15. Derive for the stability factor S for a fixed bias circuit?



$V_{CC}=I_BR_B+V_{BE}$, $I_B = \frac{V_{CC}- V_{BE}}{R_B}$ Since this equation is independent of current Ic, $\frac{dI_B}{dI_C}=0$

S = 1+β

16. Write the general expression for stability factor.

S = 1+β / 1- β *dI_B / dIc

17. Write the application of JFET.

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

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

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

19. List out the biasing methods of MOSFET.

Drain feedback bias ,Self bias

20. 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.

21. Write the conditions of thermal stability? (May 2013)

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

22. 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.

23. What is biasing. (May 2013)

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

24. What is the functions of quiescent point. (Dec 2013)

To establish certain dc current and voltage conditions to operate transistor in particular operation region at zero signal level.

25. What is thermal runaway? (May 2014)

The reverse saturation current in a semiconductor doubles for every 10 º C rise in temperature, as temperature increases the leakage current increases, and the collector current also increases. The increase in collector produces an increase in power dissipation at the collector – base junction. This, in turn further increases the temperature of the collector-base junction causing the collector current to further increase. This process may become cumulative and it is possible for the transistor to burn out. This process is known as Thermal runaway.

26. What are the parameters that affect the stability. (May 2014)

Change in β , Vbe , Ico.

27. What is thermal stability (Dec 2013)

To avoid thermal runaway the transistor circuit is designed such that the base current I_B is made to decrease automatically with rise in temperature causing the decrease in βI_B which in turn compensates for increase in collector leakage current. This is known as thermal stability and achieved by keeping $V_{CE}<V_{CC}/2$.

PART – B

1. i)Draw the circuit of a voltage divider bias circuit. Explain its operation and discuss how its stabilized V_{BE} changes.
ii) Derive the stability factor of the voltage divider bias circuit. Compare the stability factor of fixed bias circuit. Compare the stability factor of fixed bias and voltage divider bias circuit with h_{fe}=100KΩ, Re=1Ω, R1=33KΩ and R2=12 KΩ.**(Nov-2013)**

2. Explain about common source self- bias & voltage divider bias for FET**.**

3. With help of neat diagram, explain the methods used in biasing the FET and MOSFET. **(Nov-2013)**

4. Explain fixed biasing in BJT and FET. Explain the procedure for locating operating point on the characteristic curves.

5. For the voltage divider bias circuit has V_{CC} = 20V, R_C = 2KΩ , β = 50, V_{BE} = 0.2V, R_1 = 100KΩ, R_E = 100Ω. Calculate I_B, V_{CE}, I_C and the Stability Factor S.

6. What is the need for biasing? Define DC and AC load line. Explain how JFET acts as a VVR.

7. Design a collector to base bias circuit for Vcc =15V, Vce =5V, Ic = 5mA,hfe = 100.

8. 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 R_E, R_1 & R_2.

9. i) A self biased P-Channel JFET has a pinch off voltage =5V and I_{dss} = 12mA. The supply voltage available is 12V. Determine the values of resistors R_D and R_S so that I_D = 5mA and V_{ds} = 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 V_{gs} = -2.2V at I_D = 5mA

10. Explain thermistor and sensistor compensation technique

11. Explain the biasing technique of enhancement type MOSFET.

12. Explain the biasing technique of depletion type MOSFET.

13. 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**.(May 2014)**

14. Explain about the compensation technique to stabilize Q point using diode and thermistor**.(May 2014)**

15. i)Design emitter bias for BJT with I_c = 2mA, V_{cc}= 18V V_{ce} = 10 V and β = 150
ii) Derive the stability factor of self bias circuit of BJT (**Dec 2014**)

16. Design a voltage divider bias circuit for NMOS such that I_{DQ}=400μA, V_{DD}=14V, V_{DS}=2.3V, K_n=1mA/V2, V_T=1V.Assume a current of 1μA through R_1 and R_2, V_S=1.2V **(Dec-2014)**

UNIT – II BJT AMPLIFIERS

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 & step2.

2. Write the hybrid equations of CE amplifier.

$V_b = h_{ie}\, i_b + h_{re}\, V_c$

$I_c = h_{fe}\, i_b + h_{oe}\, V_c$

3. Write the uses of CE amplifier.

It is used as phase inverter.
It is used as voltage amplifier.

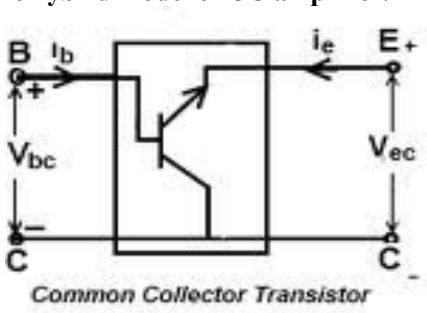
4. What is bootstrapping?

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.

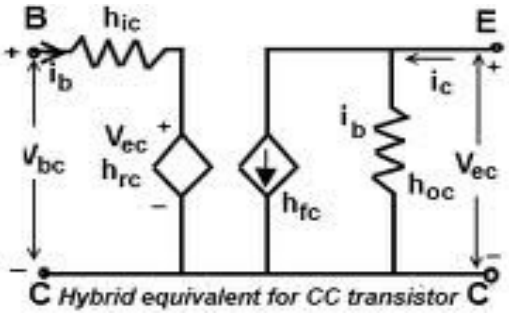
5. Write the uses of CE amplifier.

1) It is used as phase inverter. 2) It is used as voltage amplifier.

6. **Draw the hybrid model of CC amplifier.**

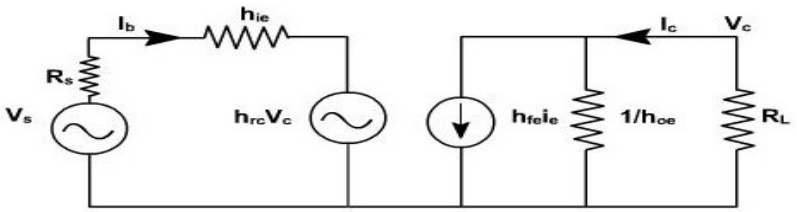


Common Collector Transistor

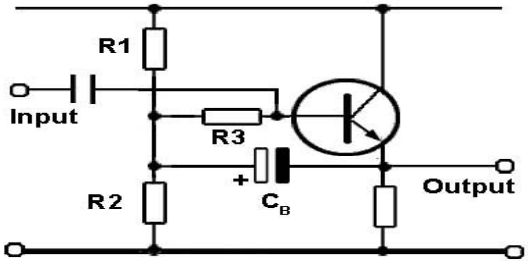


Hybrid equivalent for CC transistor

7. **Draw the hybrid model of CE amplifier**



8. **Draw a Darlington amplifier with Bootstrap Management**



9. **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.
10. **Define CMRR**
    It is the ratio of differential mode voltage gain to the common mode voltage gain.
11. **Define bisection theorem.**
    Bisection theorem states that any network which has mirror symmetry at the imaginary line, can be split into two equal networks.
12. **What is a differential amplifier?**
    An amplifier which amplifies the difference between the two inputs is called differential amplifier.
13. **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.
14. **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.
15. **List the applications of differential amplifier.**
    i. Linear amplifier
    ii. Limiter
    iii. Amplitude Modulator.
16. **What are the limitations of h-parameters?**
    i. The h-parameters can subject to variation in temperature, so it is lightly difficult to compute its accuracy.
    ii. h-parameters can be used to analyze only the small signal amplifiers.
17. **Why should a differential amplifier have a high CMRR?(May-2013)**
    In order to have output voltage free from common mode signal, the CMRR should be as large as possible.
18. **Give the condition for approximate analysis of small signal model.**
    Product of hoe. and RL' must be < 0.1.is the basic condition for approximate analysis of small signal model.

19. What is the main application of CB configuration of transistor?
CB configuration is mainly used in high frequency switches and analyzing the switching model

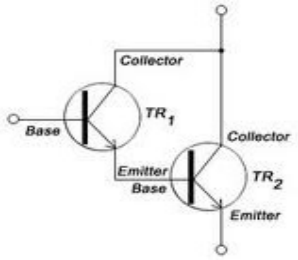
20. Define millers theorem
It states that the capacitance which connects the input and output of the circuit is split into input miller capacitance Ci and output miller capacitance Co.

21. What are the Coupling schemes used in multistage amplifiers?
1. RC Coupling 2. Transformer Coupling 3. Direct Coupling

22. What is the advantage of Darlington amplifier. (Dec 2013)
Very high overall current gain, which is normally equal to the product of CE short circuit current gains of the two transistors, h_{FE} as high as 30,000

23. Write the characteristics of CC amplifier (Dec 2013)
Input impedance is high.
Output impedance is low
Current gain is high.
Voltage gain is unity

24. Draw the circuit diagram of Darlington type amplifier (May 2013)



25. What is Darlington Connection(May 2014)
The main features of the Darlington connection is that the composite transistor act as a single unit with a current gain that is the product of the current gains of the individual transistors.
βo=β1*β2

26. List out the advantages of h parameters(Dec 2014)
1. h-parameters are Real numbers up to radio frequency
2. They can be determined from transistor static characteristics curves
3. Easily convertible from configuration to other

27. Write the characteristics of CE amplifier (May 2014)
Large current gain
Large voltage gain
Voltage phase shift of 180

28. State the various methods of improving CMRR. (DEC 2014)
1. Constant current bias method
2. Use of Current mirror circuit
3. Use of Active load

PART – B

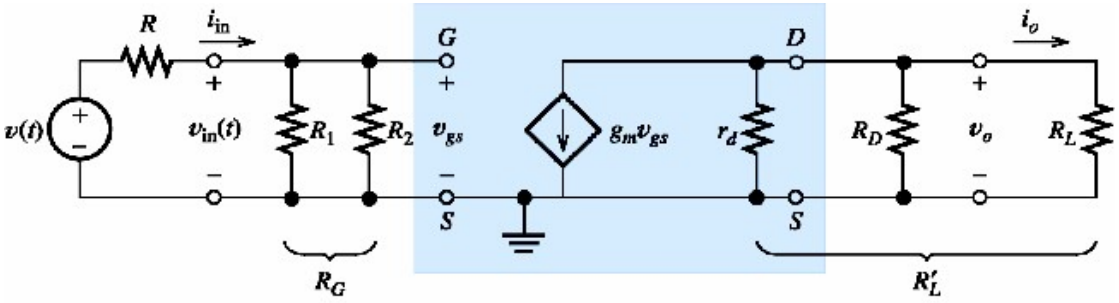
1. Explain about CB amplifier and derive the expression for h parameters of the same.
2. Explain about CC amplifier and derive the expression for gain,Ri,Ro.
3. Derive the expression for gain , input impedence and output impedence of CB amplifier.
4. Draw the circuit of a emitter coupled BJT differential amplifier and explain the operation of the circuit. Explain how the differential amplifier with a constant current stage improve the CMRR.**(Nov 2013)**
5. 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.
6. Explain the transfer characteristics of the differential amplifier.
7. Compare CB, CE and CC amplifiers and state their applications.
8. Describe the method to increase the input resistance using Darlington connection.
   (ii) Define CMRR (iii) Write short notes on multistage amplifiers.
9. The hybrid parameters of a transistor used as an amplifier in the CE configuration are h_{ie} = 800Ω, h_{fe} = 46, hoe = 80 x 10^{-6} and h_{re} = 5.4x 10^{-4} . If RL = 5K and Rs = 500Ω.Calculate Ai, Ri , Av,Ro**.**

10. Explain about CE amplifier with by passed emitter resistor and derive the expression for gain, input impedence,output impedence **(Dec 2013)**
11. Explain detail about the Class B amplifier**.(May 2014)**
12. Explain the boot strapped Darlington emitter follower with circuit diagram**(Dec 2014)**
13. Explain about darlington amplifier and derive the expression for gain, input impedance and output impedence **(Dec 2014)**
14. Explain differential amplifier and derive the expression for common mode gain and differential mode gain. **(May 2014)**
15. Explain about Class A amplifier **(Dec 2014).**
16. Explain about CE amplifier with emitter resistor and derive the expression for gain, input impedance, output impedance **(Dec 2014)**

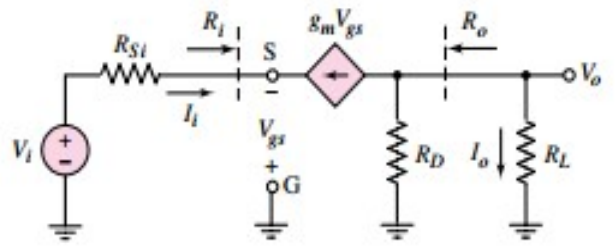
UNIT – III JFET AND MOSFET AMPLIFIERS

PART – A

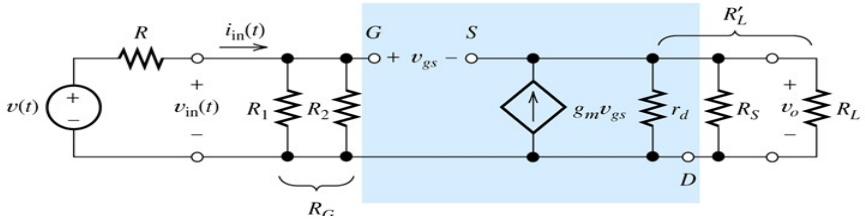
1. **Define BiMOS amplifier.**
   An amplifier whose input stage is MOSFET differential amplifier and the rest of the circuit uses BJT is called BIMOS amplifier.Since it uses both BJT and MOSFET ,it is called BIMOS.It is implemented in complementary MOS technology ,hence BIMOS is also called as BICMOS.
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. **Write the three FET parameters.**
   1.transconductance
   2.Drain resistance
   3. Amplification factor
8. **Define transconductance.**
9. It is the rate of change of drain current with gate voltage by keeing Vds constant.
   $g_m = id / Vgs \mid_{Vds}$
10. **Draw the equivalent circuit of common gate MOSFET amplifier.**



11. Draw the equivalent circuit of source follower MOSFET amplifier



12. Define drain resistance.

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

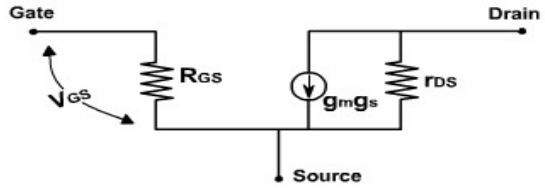
13. Define amplification factor.

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

14. What are the three types of MOSFET amplifiers?

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

15. Draw the equivalent circuit of CS FET.



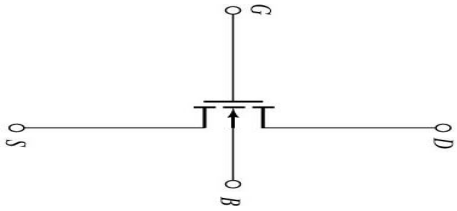
16. What do you mean by non unilateral amplifiers?

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

17. 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.

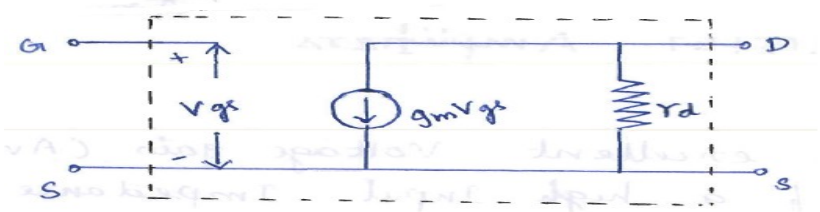
18. Draw the symbol of enhancement mode n-MOSFET.



19. Define channel length modulation.

In MOSFET if VDS 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.

20. Draw the small signal equivalent model of JFET.(Nov 2014)



21. What are the features of BiMOS cascade amplifier? (Nov 2014)

They provide infinite input impedance.

Due to larger transconductance they provide larger voltage gain

PART-B

1. Explain about JFET CG amplifier and derive the expression for gain, input impedence and output Impedence.
2. Explain about JFET CD amplifier and derive the expression for gain, input impedance and output Impedence.
3. Explain about MOSFET CS amplifier and derive the expression for gain, input impedence and output impedence .
4. Explain about MOSFET CG amplifier and derive the expression for gain, input impedence and output impedence.
5. Explain about MOSFET CD amplifier and derive the expression for gain, input impedence and output impedence.
6. Explain the operation of BIMOS cascode amplifier with a neat diagram.
7. Explain the small signal equivalent of MOSFET common source with and without resistance?
8. Explain the small signal equivalent of MOSFET common drain or source follower?
9. Derive gain, input and output impedance of common source JFET amplifier wit neat circuit diagram and equivalent circuit**.(Dec 2014)**
10. Derive gain, input and output impedance of MOSFET source follower wit neat circuit diagram and equivalent circuit.**(Dec 2014)**

UNIT – IV FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS

PART – A

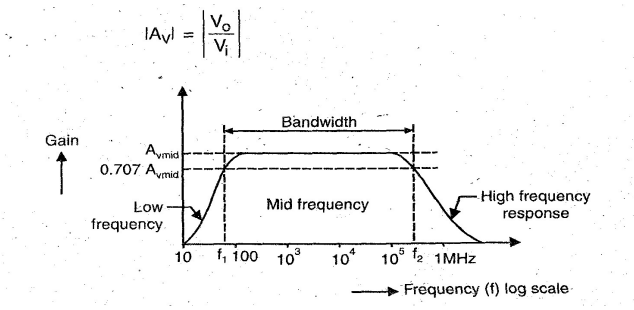
1. **State the reason for fall in gain at low and high frequencies.**
   The coupling capacitance has very high reactance at low frequency, therefore it will allow only a small part of signal from one stage and in addition to that the bypass capacitor cannot bypass the emitter resistor effectively. As 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_β**
   f_T – It is the frequency at which short circuit gain becomes unity.
   f_β - 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. **What is multistage amplifier?**
    It is an amplifier which has more than one no. of stages to increase the gain of the amplifier.
12. **Define bandwidth.**
    It is the difference between the upper cut off frequency and the lower cutoff frequency.

13. Write the disadvantage of RC coupled amplifier.

The circuit is complex.

The gain is reduced.

14. Draw the frequency response of amplifiers.



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 2KH$_z$. 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

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 ?

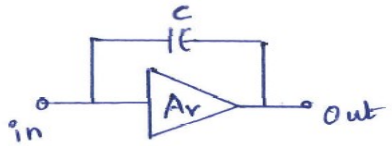
Bandwidth is defined as the range of frequency over which the gain remains constant.

20. Define the term gain bandwidth product? (Nov 2014)

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

21. What is the effect of Millers capacitance on the frequency response of an amplifier? (Nov 2014)

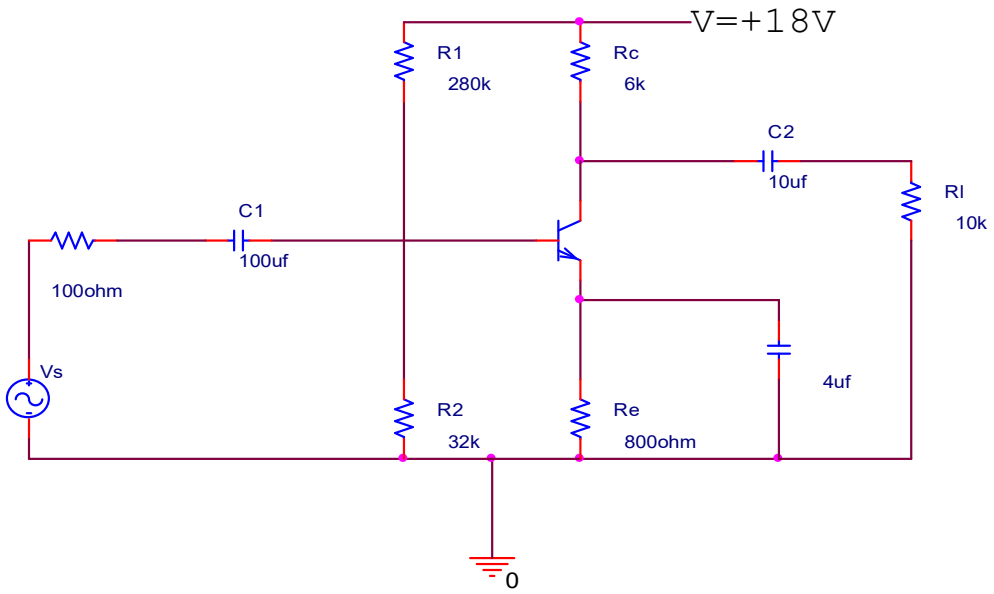
To split the capacitance between input and the output(c & D) millers capacitance can be used.



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 cut-off 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 impedence and output impedence .
9. Explain the effects and analysis of MOSFET internal capacitance?
10. Explain in detail about the Miller theorem and Miller effect?
11. i) Derive $f_\alpha, f_\beta, f_\gamma$ **(Dec 2014)**
    ii) For the circuit shown find the cut off frequencies due to c_1 and c_2 with hfe = 100 and hie = 1.4 k ohms **(Dec 2014)**



12. Explain the high frequency operation of common source amplifier with its equivalent circuit**. (Dec 2014)**

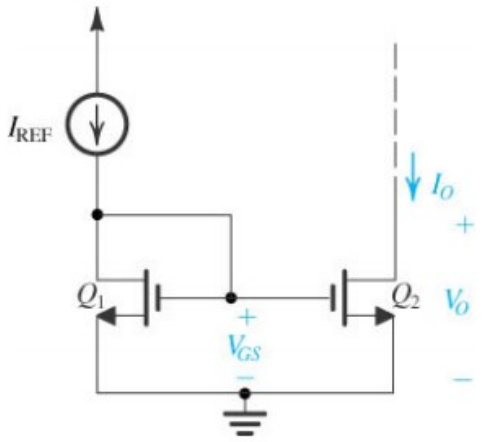
UNIT V IC MOSFET AMPLIFIERS
PART - A

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 2..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 Gate tunneling currents 5. 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 depiction 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 mirror?**



11. **How does the body 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 VT 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. **Define Threshold voltage i**n CMOS?
    The Threshold voltage, VT for a MOS transistor can be defined as the voltage applied between the gate and the source of the MOS transistor below which the drain to source current, IDS effectively drops to zero
14. **Define Short Channel devices?**
    Transistors with Channel length less than 3- 5 microns are termed as Short channel devices. With short channel devices the ratio between the lateral & vertical dimensions are reduced.(a) Non-Saturated Region(b) Saturated Region
15. **Difference between PMOS and NMOS?**
    (1) NMOS (n-type MOS transistor)
    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
18. **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.

19. Compare between CMOS and bipolar technologies ?

CMOS	Bipolar Technology
High Input impedance(Low drive current)	Low Input Impedance (High drive current)
High packing density	Low packing density
Bidirectional Capability	Essentially unidirectional
Low gm	High gm
Higher switching speeds	Speed of switching is less.

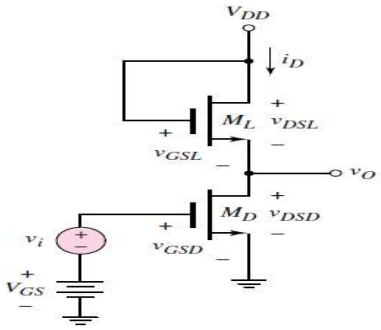
20. List out the advantages of CMOS?

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.

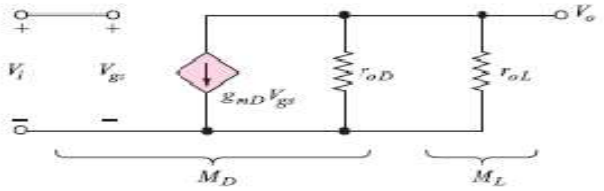
21. Discuss the physical meaning the small signal circuit parameter ro?

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

22. Sketch the NMOS amplifier with enhancement load?



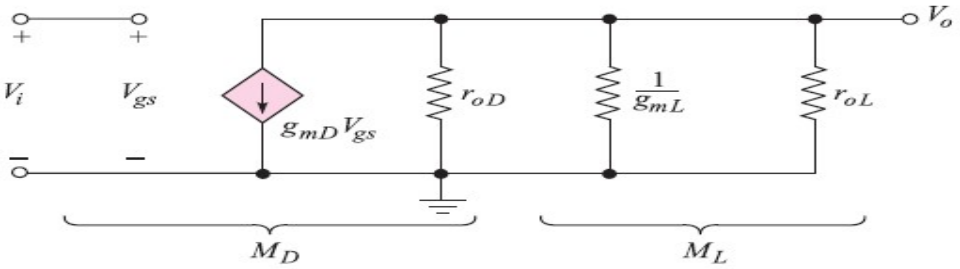
23. Draw the small signal equivalent circuit for NMOS Invertor with depletion load?



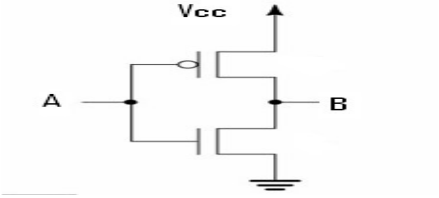
MD=Driver Transisttor

ML=Load Transistor

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



25. Sketch the CMOS invertor?



26. Difference between depletion load NMOS and Enhancement load NMOS?

Enhancement NMOS with VGS = VDS

While $V_{OUT} < V_{DD} - V_{T:}$ Transistor will be in saturation

While $V_{GS} > V_T$: Transistor will be in linear region

While $V_{OUT} > V_{DD}-V_T$:Transistor will be in Cutt off region

Depletion NMOS with $V_{GS} = 0$

$V_{GS} > V_T$: always conducting

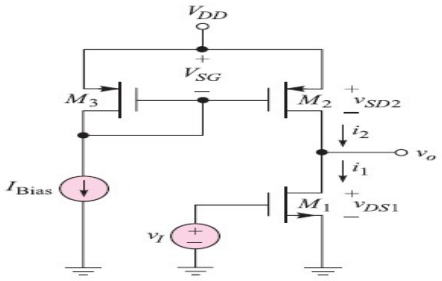
27. What are advantages of CMOS over NMOS?

The small transistor size and low power dissipation of CMOS circuits are its advantages. The logic 1 at the output is strong

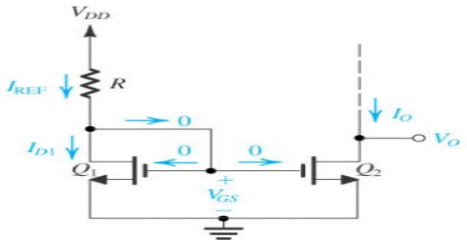
28. Features of CMOS source follower?

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

29. Draw a CMOS amplifier with NMOS driver and PMOS as active load. (Dec 2014)



29. Draw the basic MOSFET constant current source? (Dec 2014)



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. Describe the working principle of Basic MOSFET current source circuit with neat circuit?
6. Describe the working principle of Basic MOSFET current mirror circuit with neat circuit?
7. Explain the circuit principle of CMOS common source amplifier circuit?
8. Explain the circuit principle of CMOS source follower amplifier circuit ?
9. Compare the difference of NMOS depletion load,NMOS enhancement load &CMOS invertor?
10. Derive gain, input and output impedance of common source amplifier with NMOS diode connected active load. **(Dec 2014)**
11. Draw a MOS current steering circuit with two sink and two source terminals. Write the expression for the terminal currents in terms of reference current. **(Dec 2014)**