Sheet-1-

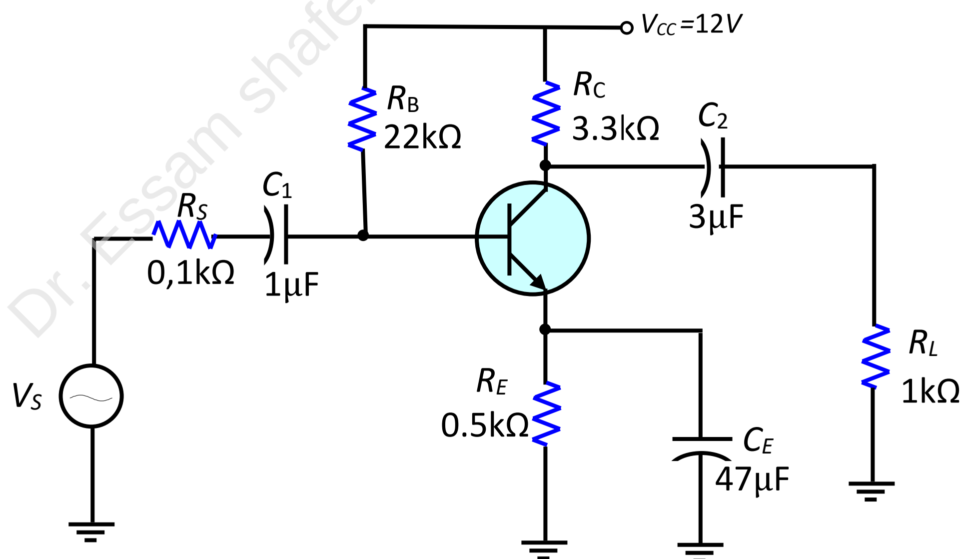
1) In Figure.1, the silicon transistor has $h_{fe} = 90$, $h_{ie} = 1k\Omega$, $h_{oe} = 0$ and $h_{re}=0$. Find:

a) The equivalent circuit. b) The current gain $A_i = i_o/i_i$

c) The voltage gain $A_V = v_o/v_i$.

d)The input impedance Z_{in} seen by the signal voltage source V_{in}.

e)The output impedance Z_{out} seen by the load R_L



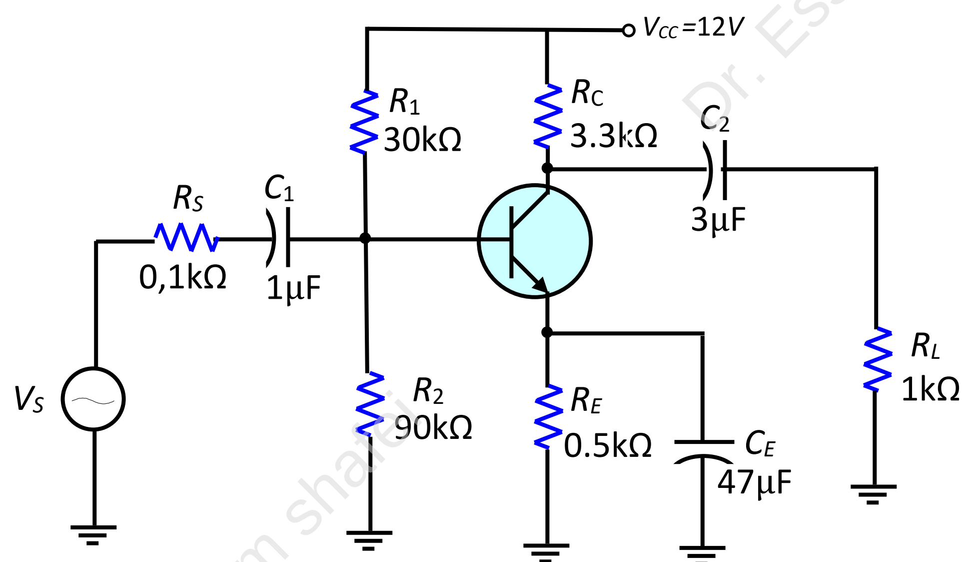
2) For the amplifier circuit shown in Fig.2, the transistor has the following small signal parameters $h_{fe} = 90$, $h_{ie} = 1k\Omega$, $h_{oe} = 10^{-2}$m-mho and $h_{re}=10^{-4}$. Find:

a) The equivalent circuit. b) The current gain $A_i = i_o/i_i$

c) The voltage gain $A_V = v_o/v_i$.

d)The input impedance Z_{in} seen by the signal voltage source V_{in}

e)The output impedance Z_{out} seen by the load R_L



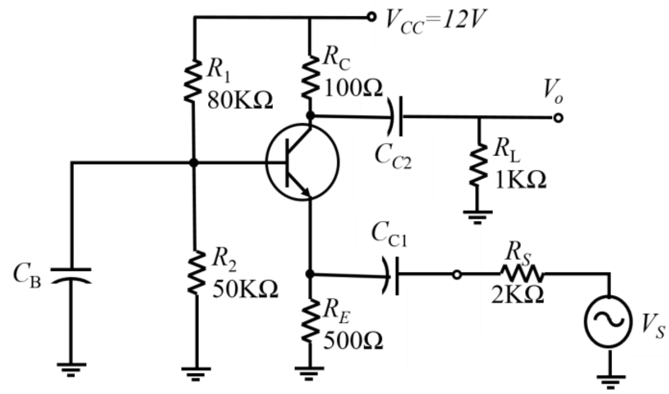
3. In Fig.3, the silicon transistor has $h_{fe} = 100$, $h_{ie} = 1K\Omega$, and $h_{oe} = h_{re} = 0$. Find:

a) The equivalent circuit.

b) The voltage gain $A_V = v_o/v_i$.

c)The input impedance Z_{in} seen by the signal voltage source V_{in}.

d) The output impedance Z_{out} seen by the load resistance R_L.



4. In Fig.4, the silicon transistor has $h_{fe} = 100$, $h_{ie} = 1K\Omega$, and $h_{oe} = h_{re} = 0$. Find:

a) The equivalent circuit.

b) The voltage gain $A_V = v_o/v_i$.

c)The input impedance Z_{in} seen by the signal voltage source V_{in}.

d) The output impedance Z_{out} seen by the load resistance R_L.

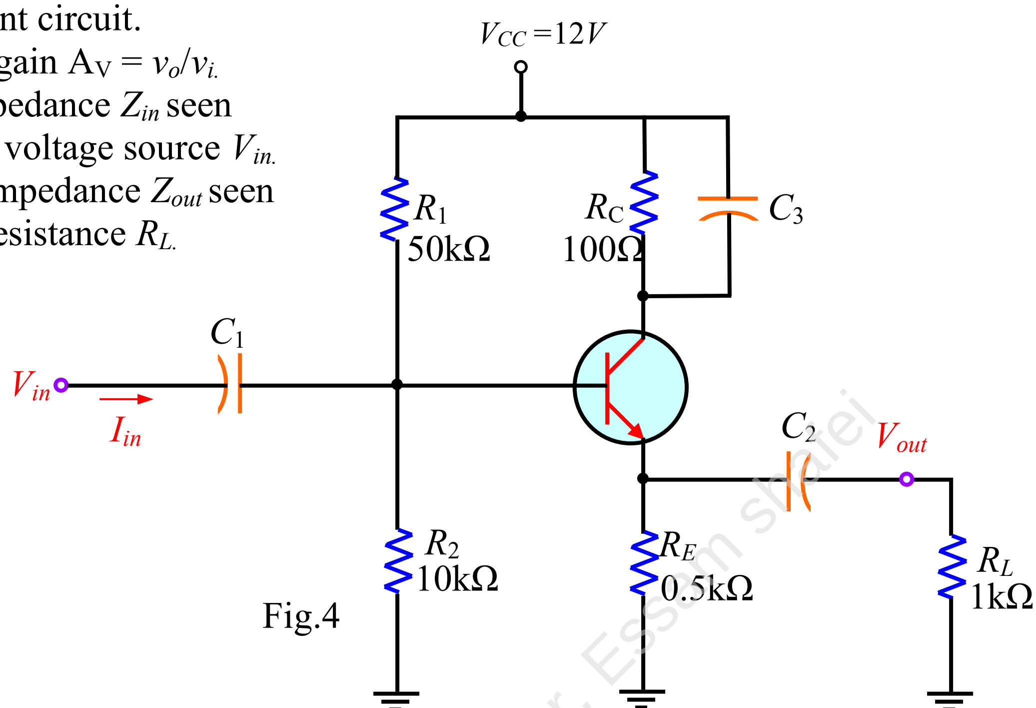


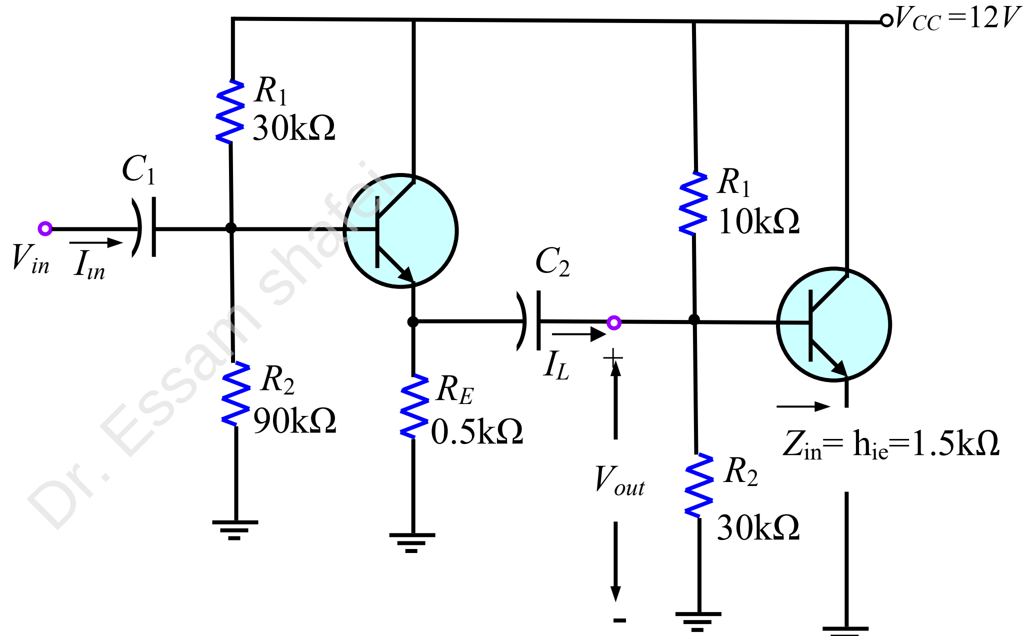
Fig.4

5) In Figure.5, the silicon transistor has $h_{fe} = 90$, $h_{ie} = 1k\Omega$, $h_{oe} = 10^{-2}$m-mho and $h_{re}=10^{-4}$. Find:

a) The equivalent circuit.

b) The current gain $A_i = i_o/i_i$

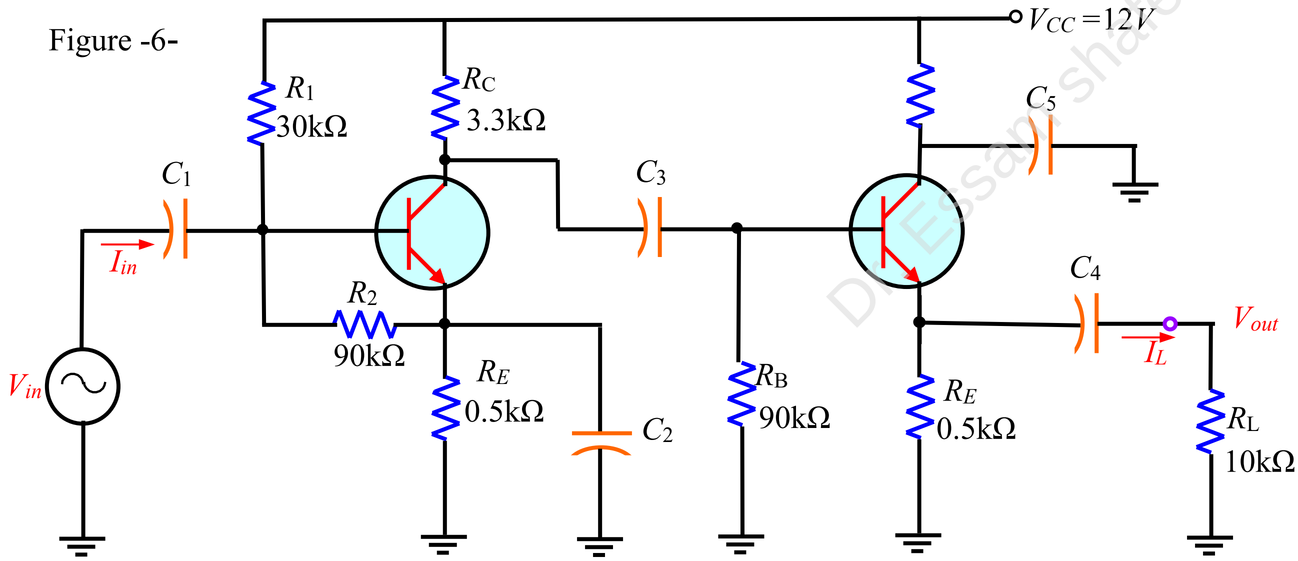
c) The voltage gain $A_V = v_o/v_i$.
d)The input impedance Z_{in} seen by the signal voltage source V_{in}.
e) The output impedance Z_{out} seen by the input impedance Z_{in} of Q_2.



6. For the multistage amplifier in Figure.6, the silicon transistors have h_{fe} = 90, h_{ie} = 1kΩ, and $h_{oe} = h_{re} = 0$. Find:

a) ac equivalent circuit
b) overall current gain
c) overall voltage gain
d)The input impedance Z_{in} seen by the signal voltage source V_{in}.
e) The output impedance Z_{out} seen by the load resistance R_L.

Figure -6-



Sheet-2-

Design & Construction of Equipment Components

1- If a 50 mV rms input signal is applied to the amplifier in Figure 2-1, what is the peak-to-peak output voltage? g_m = 5000 mA/V , r_{ds}= 50 kΩ.

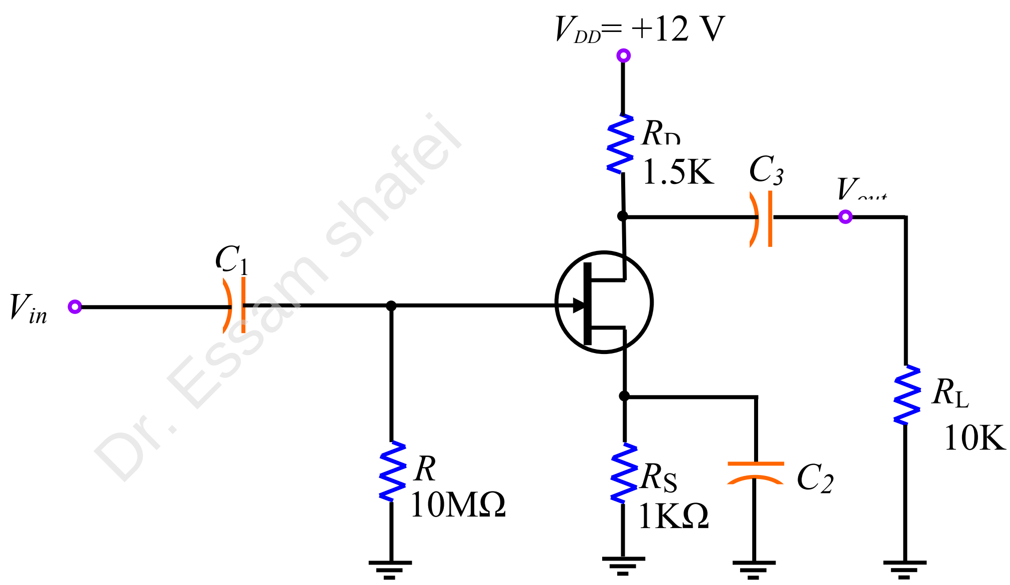


Figure 2-1

2- If a load1500Ω is ac coupled to the output in Figure 2-1, what is the resulting output voltage (rms) when a 50 mV rms input is applied? g_m = 5000 mA/V, r_{ds}= 50 kΩ.

3-Determine the voltage gain of each common-source amplifier in Figure 2-2. r_{ds}= 100 kΩ

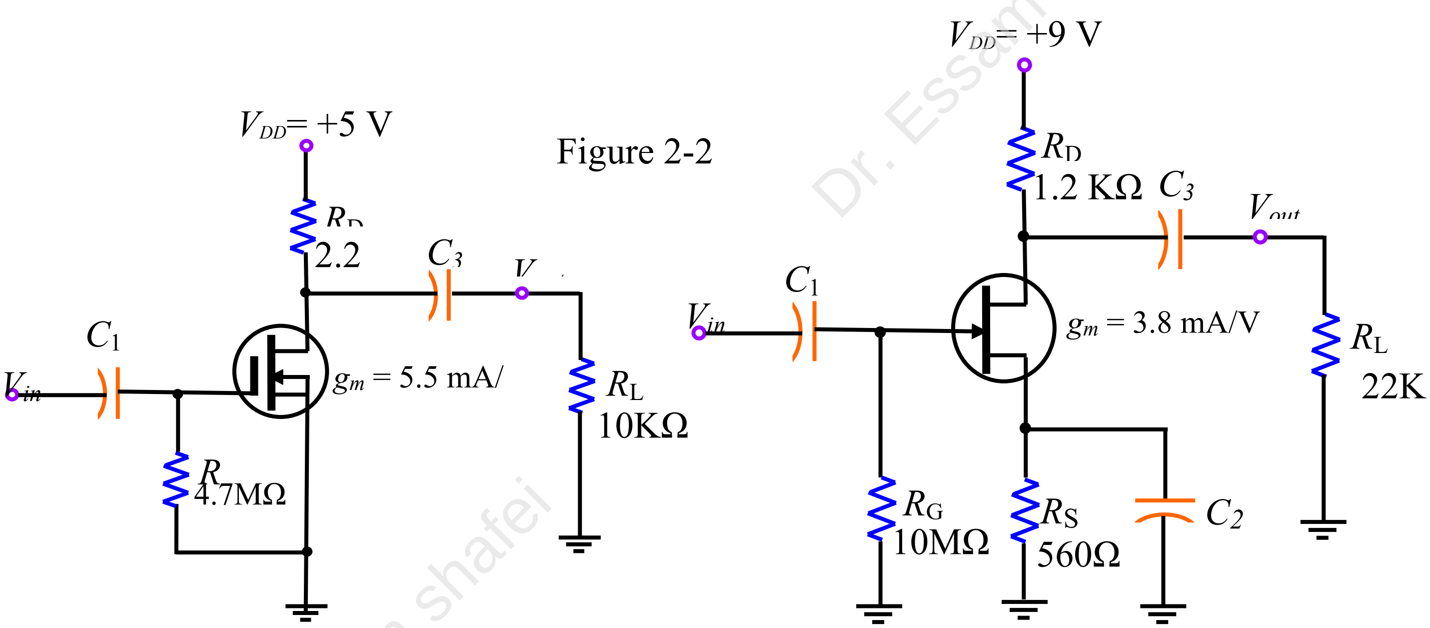


Figure 2-2

4- Draw the dc and ac equivalent circuits for the amplifier in Figure 2-3.

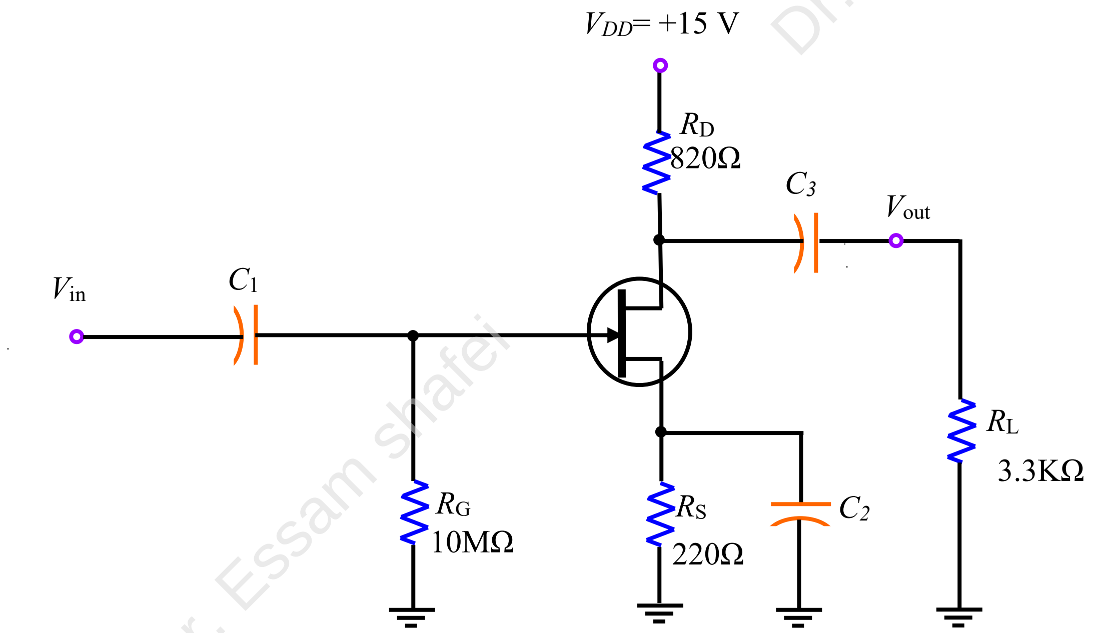


Figure 2-3

5- Find the gain of each amplifier in Figure 2-4.

6-Determine the voltage gain of each amplifier in Figure 2-4 when the capacitively coupled load is changed to 10 kΩ, r_{ds}= 50 kΩ .

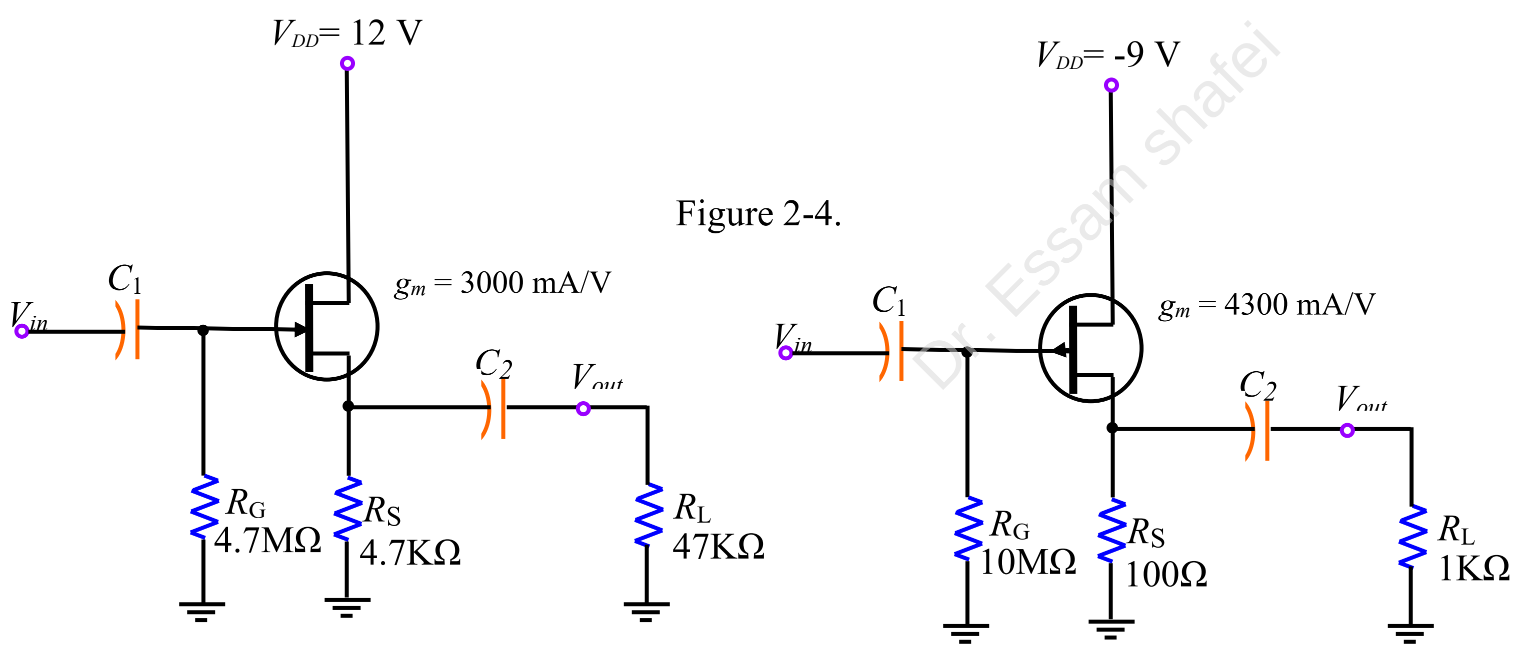


Figure 2-4.

7- Determine the voltage gain and input resistance of the common-gate amplifier in Figure 2-5.(r_{ds}= 50 kΩ)

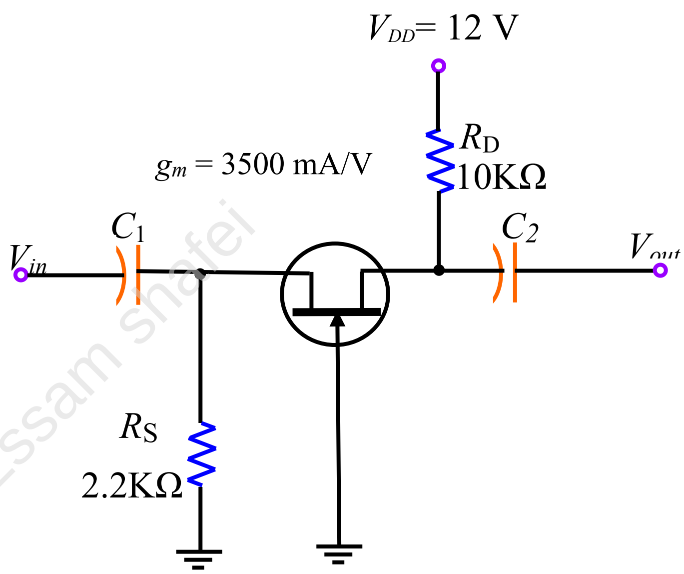


Figure 2-5

Sheet-3-

Design & Construction of Equipment Components

1) **Choose the correct answer**

1. A thyristor has
(a) two *pn* junctions
(b) three *pn* junctions
(c) four *pn* junctions
(d) only two terminals

2. Common types of thyristors include
(a) BJTs and SCRs
(b) UJTs and PUTs
(c) FETs and triacs
(d) diacs and triacs

3. A 4-layer diode turns on when the anode-to-cathode voltage exceeds
(a) 0.7 V
(b) the gate voltage
(c) the forward-breakover voltage
(d) the forward-blocking voltage

5. An SCR differs from the 4-layer diode because
(a) it has a gate terminal
(b) it is not a thyristor
(c) it does not have four layers
(d) it cannot be turned on and off

6. An SCR can be turned off by
(a) forced commutation
(b) a negative pulse on the gate
(c) anode current interruption
(d) answers (a), (b), and (c)

7-The silicon-controlled switch (SCS) is similar in construction to the
(a) triac.
(b) diac.
(c) SCR.
(d) 4-layer diode

8. You need a very *efficient* thyristor to control the speed of an AC fan motor. A good device to use would be
(a) 4-layer diode.
(b) a PUT.
(c) triac.
(d) a BJT

9. In the forward-blocking region, the SCR is
(a) reverse-biased
(b) in the *off* state
(c) in the *on* state
(d) at the point of breakdown

10. The specified value of holding current for an SCR means that
(a) the device will turn on when the anode current exceeds this value
(b) the device will turn off when the anode current falls below this value
(c) the device may be damaged if the anode current exceeds this value
(d) the gate current must equal or exceed this value to turn the device on

11. The diac is

(a) a thyristor
(b) a bilateral, two-terminal device
(c) like two parallel 4-layer diodes in reverse directions
(d) answers (a), (b), and (c)

12. The triac is

(a) like a bidirectional SCR
(b) a four-terminal device
(c) not a thyristor
(d) answers (a) and (b)

13. The SCS differs from the SCR because

(a) it does not have a gate terminal
(b) its holding current is less
(c) it can handle much higher currents
(d) it has two gate terminals

14. The SCS can be turned on by

(a) an anode voltage that exceeds forward-breakover voltage
(b) a positive pulse on the cathode gate
(c) a negative pulse on the anode gate
(d) either (b) or (c)

15. The SCS can be turned off by

(a) a negative pulse on the cathode gate and a positive pulse on the anode gate
(b) reducing the anode current to below the holding value
(c) answers (a) and (b)
(d) a positive pulse on the cathode gate and a negative pulse on the anode gate

16. Which of the following is *not* a characteristic of the UJT?

(a) intrinsic standoff ratio
(b) negative resistance
(c) peak-point voltage
(d) bilateral conduction

17. The PUT is

(a) much like the UJT
(b) not a thyristor
(c) triggered on and off by the gate-to-anode voltage
(d) not a four-layer device

2) In a certain UJT, $r'_{B1} = 2.5\ K\Omega$ and $r'_{B2} = 4\ K\Omega$. What is the intrinsic standoff ratio?

3) Determine the peak-point voltage for the UJT in Problem 2 if V_{BB} =15V.

4) The intrinsic stand-off ratio for a UJT is determined to be 0.6. If the inter-base resistance is 10 kΩ, what are the values of R_{B1} and R_{B2} ?

5) A unijunction transistor has 10 V between the bases. If the intrinsic stand-off ratio is 0.65, find the value of stand-off voltage. What will be the peak-point voltage if the forward voltage drop in the pn junction is 0.7 V ?

6) Determine a value of R_1 in Figure 3.1 that will ensure proper turn-on and turn-off for the following values: $\eta = 0.33$, $V_V = 0.8$ V, $I_V = 15$ mA, $I_P = 35$ µA, and $V_P = 18$ V.

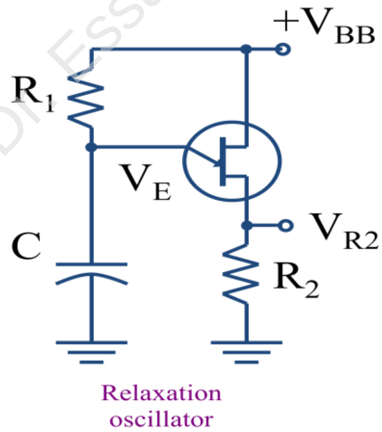


Figure 3.1

7) For *the relaxation oscillator shown in Figure 3.2 . The parameters of the UJT are* $R_{BB} = 5\ k\Omega$ *and* $\eta = 0.6$.
(*i*) *Determine* R_{B1} *and* R_{B2} *at* $I_E = 0$.
(*ii*) *Calculate the voltage* V_P *necessary to turn on the UJT.*
(*iii*) *Determine the frequency of oscillations if,*
$V_V = 0.8$ V, $I_V = 12$ mA, $I_P = 30$ µA,

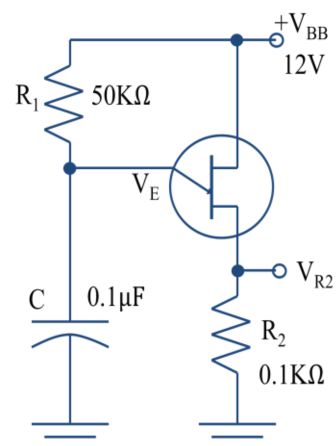


Figure 3.2

Sheet-4-

Design & Construction of Equipment Components

1) Choose the correct answer

1. An amplifier that operates in the linear region at all times is
(a) Class A **(b)** Class AB **(c)** Class B **(d)** Class C

2. A certain class A power amplifier delivers 5 W to a load with an input signal power of 100 mW. The power gain is
(a) 100 **(b)** 50 **(c)** 250 **(d)** 5

3. The peak current a class A power amplifier can deliver to a load depends on the
(a) maximum rating of the power supply **(b)** quiescent current
(c) current in the bias resistors **(d)** size of the heat sink

4. A certain class A power amplifier has V_{CEQ} = 12 V and I_{CQ} = 1 A. The maximum signal power output is
(a) 6 W **(b)** 12 W **(c)** 1 W **(d)** 0.707 W

5. The efficiency of a power amplifier is the ratio of the power delivered to the load to the
(a) input signal power **(b)** power dissipated in the last stage
(c) power from the dc power supply **(d)** none of these answers

6. The maximum efficiency of a class A power amplifier is
(a) 25% **(b)** 50% **(c)** 79% **(d)** 98%

7. The transistors in a class B amplifier are biased
(a) into cutoff **(b)** in saturation
(c) at midpoint of the load line **(d)** right at cutoff

8. Crossover distortion is a problem for
(a) class A amplifiers **(b)** class AB amplifiers
(c) class B amplifiers **(d)** all of these amplifiers

9. A BJT class B push-pull amplifier with no transformer coupling uses
(a) two *npn* transistors **(b)** two *pnp* transistors
(c) complementary symmetry transitors **(d)** none of these

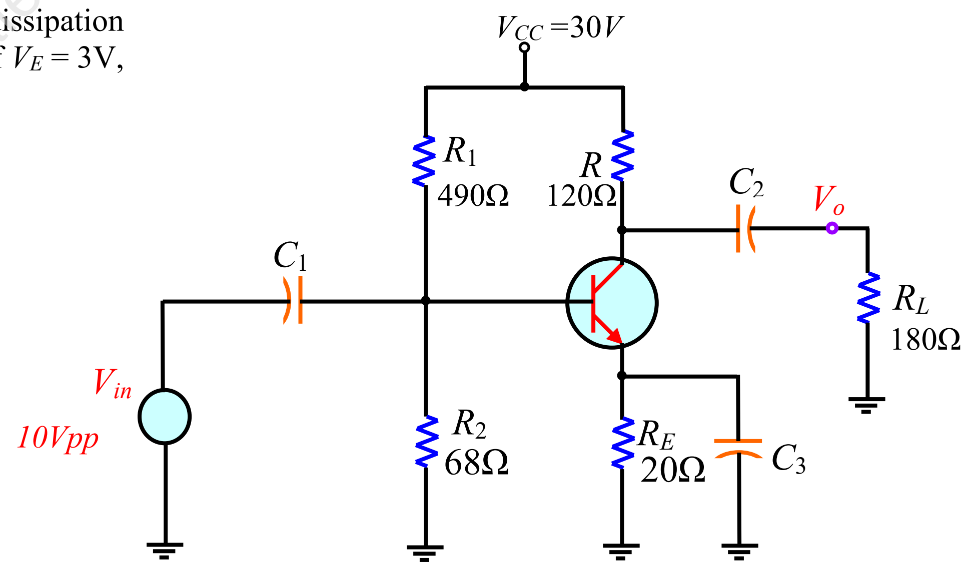
10. The maximum efficiency of a class B push-pull amplifier is
(a) 25% **(b)** 50% **(c)** 79% **(d)** 98%

11. The maximum efficiency of a class AB amplifier is
(a) higher than a class B
(b) the same as a class B
(c) about the same as a class A
(d) slightly less than a class B

12. The power dissipation of a class C amplifier is normally
(a) very low **(b)** very high **(c)** the same as a class B **(d)** the same as a class A

13. The efficiency of a class C amplifier is
(a) less than class A
(b) less than class B
(c) less than class AB
(d) greater than classes A, B, or AB

2) What is the transistor power dissipation and efficiency of Figure 4.1 if $V_E = 3V$, $h_{fe} = 50$ and $h_{ie} = 1K\Omega$



3) Calculate maximum ac output power in the class-A amplifier shown in fig. (Assume $V_{BE} = 0$)