Unit 12 - WEEK 10

Week 10 Assignment 10

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-04-08, 23:59 IST.

Common data for Q 10.1 to Q 10.3:

The circuit shown in Fig 10.1 is animproved version of current mirror.

The values of device parameters forall three transistors are given as:
$V_{BE(on)1} = V_{BE(on)2} = V_{BE(on)3} \approx 0.6V$, $V_{CE(sat)1} = V_{CE(sat)2} = V_{CE(sat)3} \approx 0.3V$, $\beta_1 = 100$, $\beta_2 = 100$, $\beta_3 = 99$. The early voltages of transistors are given as $V_{A1} = 100$ V, $V_{A2} = 100$ V. The reverse saturation currents of transistors are given as: $I_{S1} \approx 10^{-13}$ Amp and $I_{S2} \approx 10^{-13}$ Amp. Consider thermal equivalent voltage, $V_T = 26$ mV.

The power supply, $V_{CC} = 12V$ and $I_{REF} = 0.8$ mA.

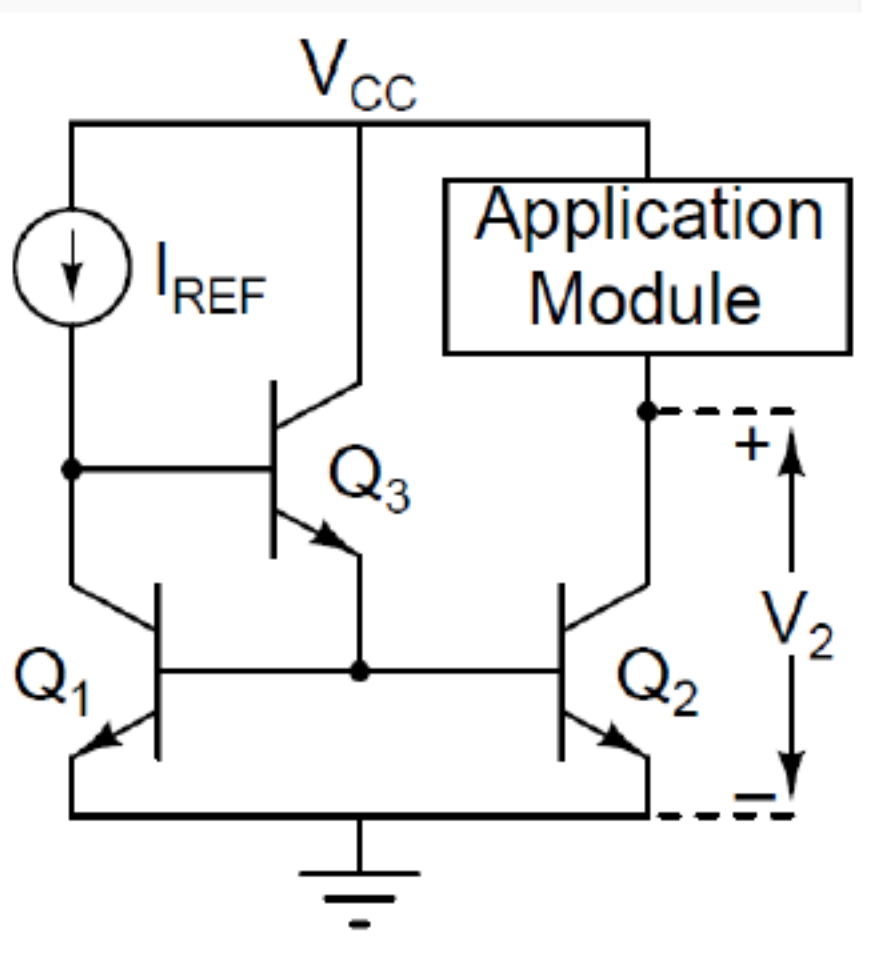

Fig 10.1

1) Refer to the circuit shown in Fig 10.1, find the value of $\Delta I = |I_{C1} - I_{C2}|$ for $V_2 = 1.2$ V. Select the closest option from the following: *0 points*

a)0.8 mA b)1.6 mA c)160nA d)0 µA e)5µA

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
c)

2) Refer to the circuit shown in Fig 10.1, find the value of $\Delta I = |I_{C1} - I_{C2}|$ for $V_2 = 5.2$ V. Select the closest option from the following: *2 points*

a) 31.45µA b) 1.6 mA c) 160nA d) 0 µA e) 0.8 mA

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
a)

3) Find the smallsignal output resistance (looking into the collector terminal of Q_2) of the circuit as shown in Fig 10.1.Select the closest option from the following: *1 point*

a) 150 kΩ b) 125 kΩ c)37 kΩ d) 62 kΩ e)31 kΩ

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

Common data for Q 10.4 to Q 10.6

The circuit shown in Fig 10.2 is a cascade current mirror.

All four transistors are identical. The values of device parameters for all four transistors are given as:
$K\frac{W}{L} = 2$ mA/V^2, $V_{th} = 1$V, $\lambda = 0.01$ V^{-1}.

The supply voltage $V_{DD} = 12$ V and $I_{REF} = 1$ mA.

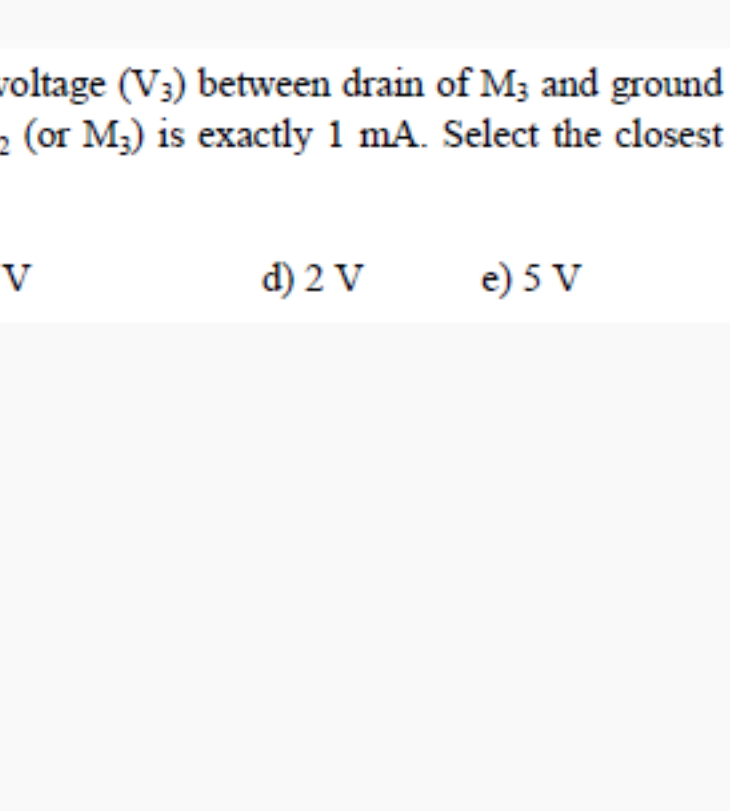

Fig 10.2

4) Refer to the circuit in Fig 10.2, find the DC voltage (V_3) between drain of M_3 and ground such that the DC current flowing through M_2 (or M_3) is exactly 1 mA. Select the closest option from the following: *2 points*

a) 3 V b) 6 V c) 4 V d) 2 V e) 5 V

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
c)

5) Find the smallsignal output resistance (looking into the drain terminal of M_3) of the circuit as shown in Fig 10.2.Select the closest option from the following: *2 points*

a) 10 MΩ b) 40MΩ c) 200 kΩ d) 20 MΩ e) 2MΩ

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
d)

6) Refer to the circuit shown in Fig 10.2, find the minimum DC value of $V_3$with which small signal output resistance remain high. Select the closest option from the following: *1 point*

a) 3 V b) 6 V c) 4 V d) 2V e) 5V

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
a)

Common data for Q 10.7 to Q 10.9:

The circuit shown in Fig 10.3 is a CE amplifier using current mirror.

The values of device parameters for all four transistors are given as:
$V_{BE(on)1} = V_{BE(on)2} = V_{EB(on)3} = V_{EB(on)4} \approx 0.6$ V, $\beta_1 = \beta_2 = 200$, $\beta_3 = \beta_4 = 250$. The early voltages of transistors are given as $V_{A1} = V_{A2} = 120$ V, $V_{A3} = V_{A4} = 100$ V.

The supply voltage, $V_{CC} = 12V$ and the current flowing through the collector terminal of Q_1 is 1.2 mA.

Consider, thermal equivalent voltage $V_T = 26$ mV. The values of R_1 and R_2 are equal. The transistors Q_1 and Q_2 are identical and similarly, the transistors Q_3 and Q_4 are identical.

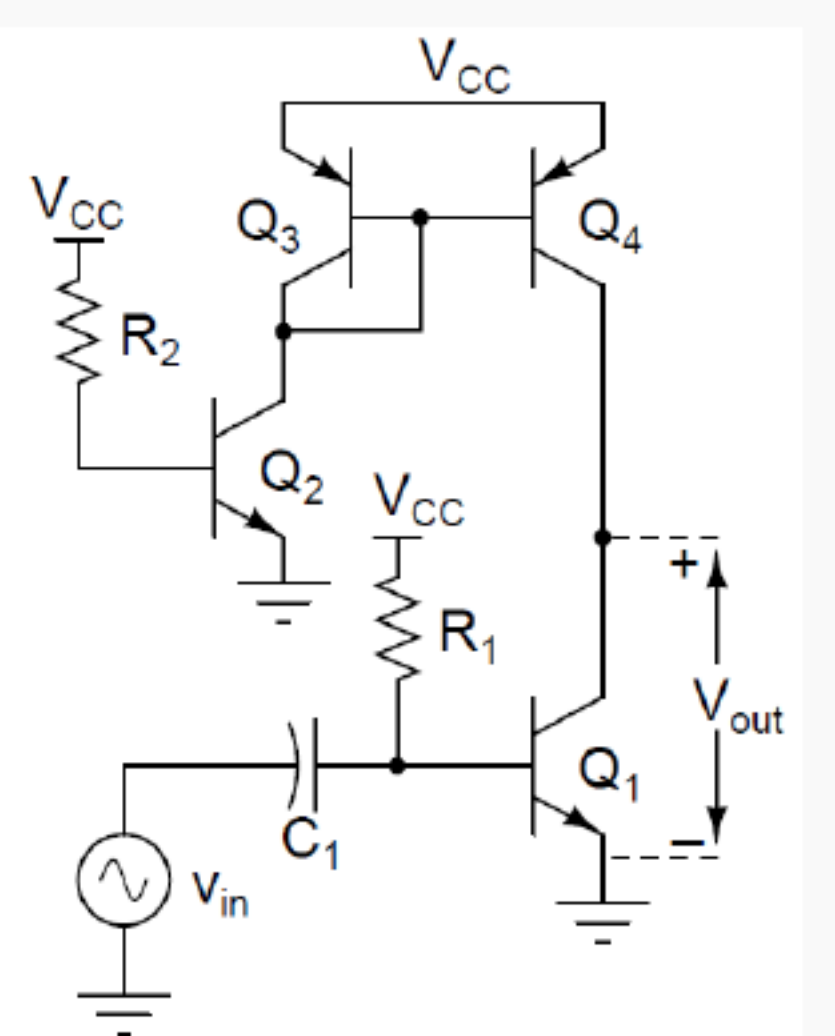

Fig 10.3

7) Find the value of R_1 as shown in Fig 10.3.Select the closest option from the following: *1 point*

a) 1.9 MΩ b) 2.4 MΩ c) 9.5 kΩ d) 3.8 MΩ e) 1 MΩ

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
a)

8) Find the precise value of DC output voltage (V_{OUT}) as shown in Fig 10.3.Select the closest option from the following: *1 point*

a) 6 V b) 11.4 V c) 5.45 V d) 6.54 V e) 11V

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

9) Find the small signal voltage gain, $|A_v| = \left|\frac{v_{out}}{v_{in}}\right|$ in mid frequency range of the amplifier circuit as shown in Fig 10.3. Assume, the coupling capacitor is shorted in mid frequency range of the amplifier.Select the closest option from the following: *1 point*

a) 4195 b) 2098 c) 8390 d) 1049 e) 19

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

Common data for Q 10.10 to Q 10.14

The circuit shown in Fig 10.4 is a single ended fully differential amplifier.

The values of device parameters for transistors are given as:
$K_n\left(\frac{W}{L}\right)_1 = K_n\left(\frac{W}{L}\right)_2 = 1$ mA/V^2, $K_n\left(\frac{W}{L}\right)_3 = K_n\left(\frac{W}{L}\right)_4 = 4$ mA/V^2, $K_p\left(\frac{W}{L}\right)_5 = K_p\left(\frac{W}{L}\right)_6 = 0.5$ mA/V^2. The remaining parameters for all transistors are given as $|V_{th}| = 1$ V, $\lambda = 0.01$ V^{-1}.
The supply voltage $V_{DD} = 12$ V. The value of V_{INC} is such that all transistors are operating in saturation region. The value of I_B is 2 mA.

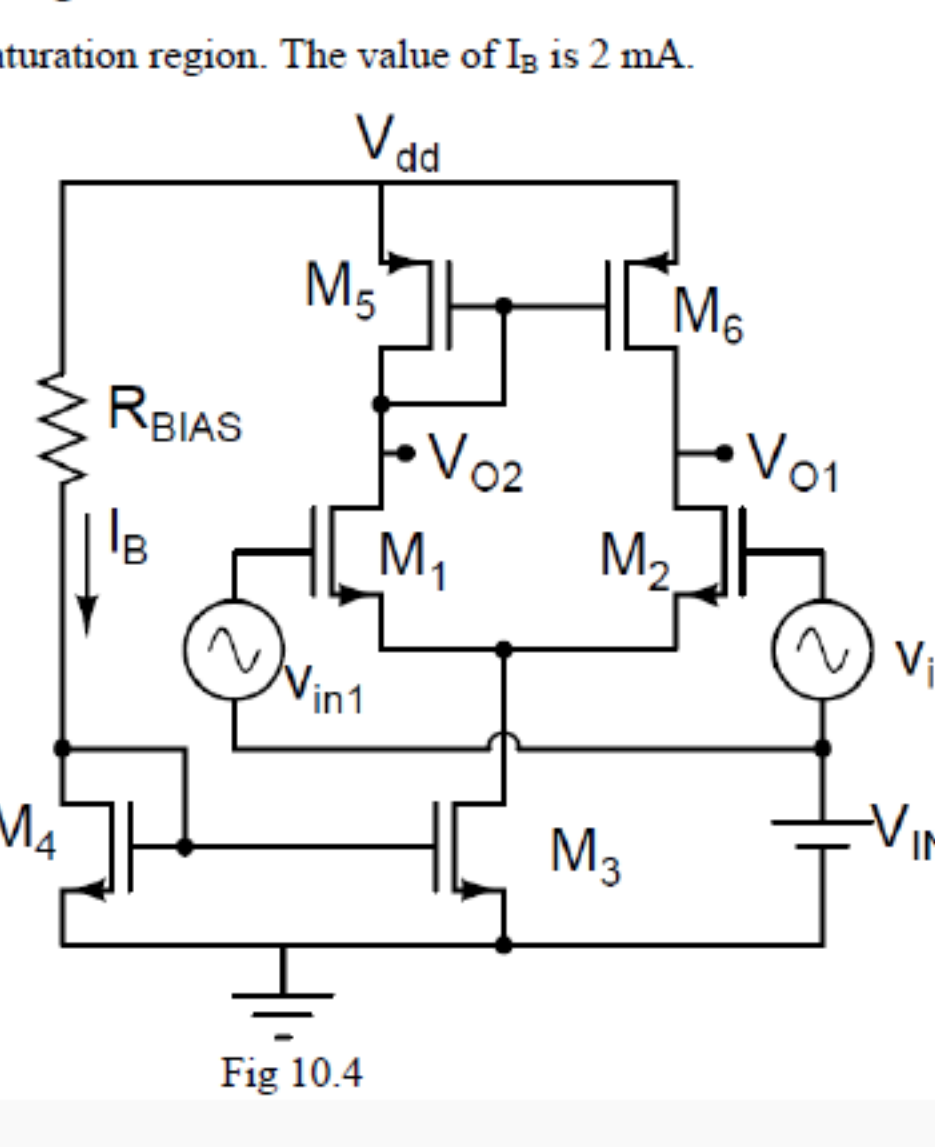

Fig 10.4

10) Find the value of R_{BIAS} such that the current flowing through it is 2 mA as shown in Fig 10.4. Select the closest option from the following: *1 point*

a) 10 kΩ b) 5 kΩ c) 2.5 kΩ d) 1.5 kΩ e) 6 kΩ

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

11) For a meaningful input common mode bias (V_{INC}), find the value of $V_{O1} = V_{O2} = V_{O\_DC}$ as shown in Fig 10.4. Select the closest option from the following: *1 point*

a) 10 V b) 8 V c) 6 V d) 9 V e) 4.7 V

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
d)

12) Refer to the circuit as shown in Fig 10.4, find the range of input common mode DC voltage (V_{INC}) such that all transistors are operating in saturation region. Select the closest option from the following: *2 points*

a) $2\text{ V} \le V_{INC} \le 9\text{ V}$ b) $2\text{ V} \le V_{INC} \le 10\text{ V}$
c) $3\text{ V} \le V_{INC} \le 9\text{ V}$ d) $3\text{ V} \le V_{INC} \le 8\text{ V}$
e) $3\text{ V} \le V_{INC} \le 10\text{ V}$ f) $2\text{ V} \le V_{INC} \le 8\text{ V}$

a)
b)
c)
d)
e)
f)

No, the answer is incorrect.
Score: 0
Accepted Answers:
e)

13) Find the differential mode gain of the differential amplifier circuit as shown in Fig 10.4. Select the closest option from the following: *2 points*

a) 71 b) 141 c) 35 d) 282 e) 6.3

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
a)

14) Find the common mode gain of the differential amplifier circuit as shown in Fig 10.4. Select the closest option from the following: *2 points*

a) – 0.6 b) – 0.1 c) – 1.41 d) – 1 e) – 0.01

a)
b)
c)
d)
e)

No, the answer is incorrect.
Score: 0
Accepted Answers:
e)