Analog Circuits Test I

Number of Questions: 35 **Time: 90 min.**

Directions for questions 1 to 35: Select the correct alternative from the given choices.

1. For a voltage controlled current source, the Input impedance and output impedances are respectively

(A) low, high (B) high, high
(C) high, low (D) low, low

2. Which of the following conditions must be satisfied to avoid thermal runaway?

(1) $\frac{\partial P_C}{\partial T_j} < \frac{1}{\theta_{jA}}$ (2) $2V_{CE} < V_{CC}$

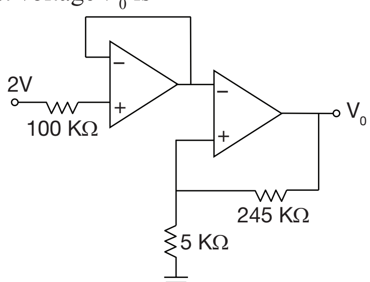
(3) $V_{CE} \geq 1/2V_{CC}$ (4) $\frac{\partial P_C}{\partial T_j} > \frac{1}{\theta_{jA}}$

(A) 1 and 2 only (B) 3 only.
(C) 1 and 3 only (D) 2 and 4 only

3. In a JFET amplifier, the source resistance R_s is un bypassed. Find the voltage gain of the amplifier. Given g_m = 4ms, R_D = 2kΩ and R_s = 500Ω

(A) 2.66 (B) 1.53
(C) 2.25 (D) 1.8

4. The output voltage V_0 is



(A) 100 V (B) –98 V
(C) 1.96 V (D) 10 V

5. What are the effects of Darlington pair?

(1) High input impedance (2) High current gain
(3) Unity voltage gain (4) Low current gain

(A) 1, 2 and 3 (B) 1, 2 and 4
(C) 1, 3 and 4 (D) 1 and 3 only

6. An *RC* amplifier stage has the rise time 0.75µsec, what will be the bandwidth of this amplifier stage?

(A) 500 KHz (B) 450 KHz
(C) 540 KHz (D) 467 KHz

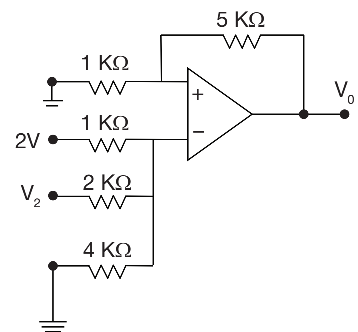
7. The open loop voltage gain of an amplifier is 250. The noise level in the output without feedback is 100mV. If a negative feedback with $\beta = \frac{1}{50}$ is used, the noise level in the output will be

(A) 16.66 mV (B) 20 mV
(C) 1.66 mV (D) 0.6 V

8. What is the main source of distortion in a push – pull amplifier?

(A) All odd harmonics
(B) All even harmonics
(C) Third harmonic
(D) Fundamental components

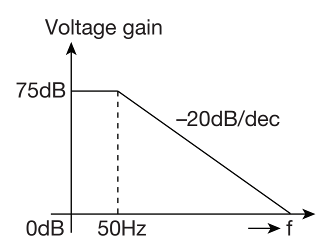
9.



If the output V_0 = 12 V, then the input voltage V_2 is ________

(A) 3 V (B) 2 V
(C) –3 V (D) 6 V

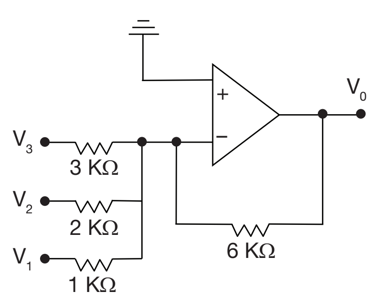
10. The voltage gain versus frequency curve of an op – amp is shown in the given figure



The gain – bandwidth product of the op – amp is

(A) 250 KHz (B) 2.5 MHz
(C) 281 KHz (D) 2.8 MHz

11. If V_1 = 2V, V_2 = –3V and V_3 = 1V, then the output voltage V_0 is

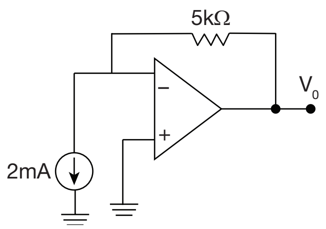


(A) 0 V (B) –10 V
(C) –5 V (D) 2.5 V

12. An ideal operational amplifier is a

(A) CCVS (B) CCCS
(C) VCVS (D) VCCS

13.



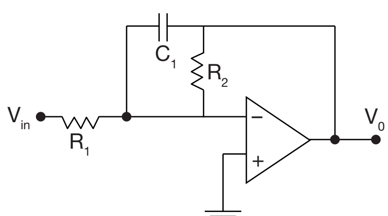
The output voltage V_0 is

(A) –10 V (B) 5 V
(C) 10 V (D) –2.5 V

14. A dc voltage supply provides 50 V when the output is unloaded. When connected to a load, the output drops to 45 V. Then the voltage regulation is

(A) 7.3% (B) 10%
(C) 11.11% (D) 13.24%

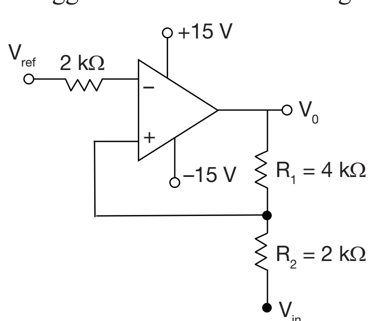
15.



The given circuit represents a

(A) BPF (B) HPF
(C) APF (D) BSF

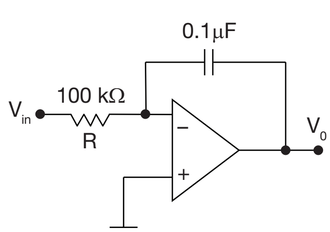
16. The schmitt trigger circuit shown in the figure



If V_{ref} = –2V, then the values of V_{UT} and V_{LT} are

(A) 4.5 V, –10.5 V (B) 10.5 V, –4.5 V
(C) 7.5 V, –7.5 V (D) 5.5 V, –9.5 V

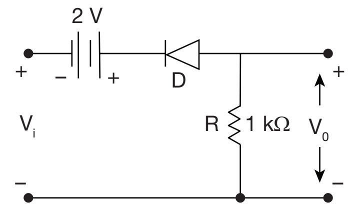
17.



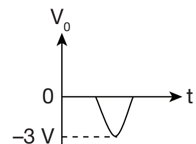
If $V_{in} = 5 + 1.5t^2$ Volts, then the output voltage of the given circuit at t = 0.5sec is

(A) –1.5 V (B) –3.84 V
(C) –5.375 V (D) –2.5625 V

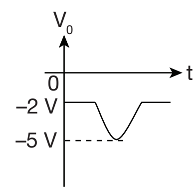
18. Determine V_0 for the network of figure, for the input $V_i(t) = 5\sin\omega t$ Volts.



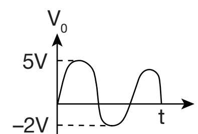
(A)



(B)

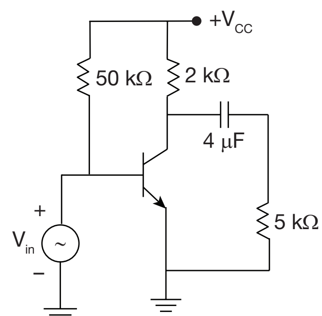


(C)



(D) None of these

19. The cut – off frequency due to the output capacitor is _______

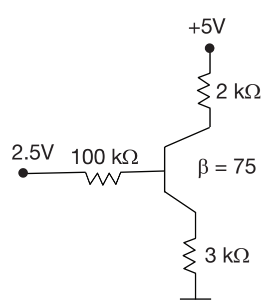


(A) 35.71 Hz (B) 5.68 Hz
(C) 47.746 Hz (D) 8.25 Hz

20. The unity gain bandwidth of a n – channel MOSFET amplifier having V_{Tn} = 2V, and biased at V_{GS} = 4 V. The high frequency n – channel MOSFET parameters are $K_n = 0.5\mu A/V^2$, C_{gd} = 0.05pF, C_{gs} = 0.2pF.

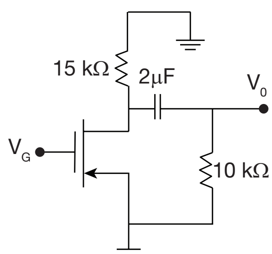
(A) 2.546 kHz (B) 2.546 MHz
(C) 1.273 kHz (D) 1.273 MHz

21. Find the region of operation of the transistor.



(A) Cut – off (B) Saturation
(C) Active (D) Inverse active

22. The ac schematic of an PMOS common – source gate is shown in the figure below. For P – channel MOSFET, the trans conductance, g_m = 2mA/V, body effect and channel length modulation effects are to be neglected. Then the lower cut – off frequency of the circuit is approximately at



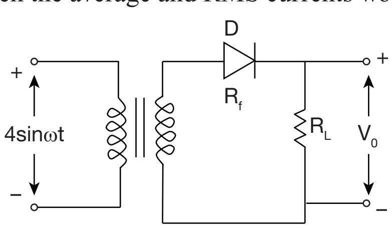
(A) 20 Hz (B) 25 Hz
(C) 83.33 Hz (D) 523.59 Hz

23. Match List – I(amplifier mode of operation) with List – II (Characteristics) and select the correct answer using the codes given below the lists.

	List – I		List – II
p	Class – A	1	Transistor acts as switch
q	Class – B	2	Leads to most stable biasing circuit
r	Class – C	3	Amplification of the resonant frequency only
s	Class – D	4	Operating point is at the cut – off point.

Codes;
(A) $p-2, q-4, r-1, s-3$
(B) $p-4, q-2, r-3, s-1$
(C) $p-2, q-4, r-3, s-1$
(D) $p-4, q-2, r-1, s-3$

24. Consider the circuit given below where $R_f = 250\Omega$, R_L = 3 $k\Omega$. Then the average and RMS currents would be

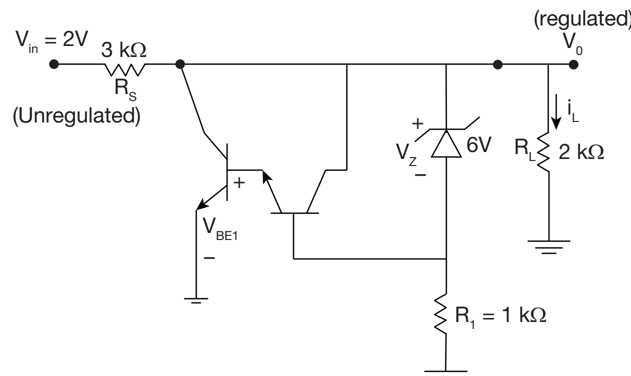


(A) I_{avg} = 1.23 mA, I_{rms} = 0.615 mA
(B) I_{avg} = 0.87 mA, I_{rms} = 0.39 mA
(C) I_{avg} = 0.39 mA, I_{rms} = 0.87 mA
(D) I_{avg} = 0.39 mA, I_{rms} = 0.615 mA

25. Determine the output voltage of an op – amp for input voltages of V_{i1} = 150 μV and V_{i2} = 110 μV. The amplifier has a differential gain of A_d = 2000 and the value of CMRR is 80
(A) 83.25 mV (B) 75 mV
(C) 8.32 mV (D) 60 mV

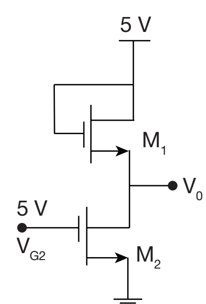
26. Calculate the total harmonic distortion for an output signal having fundamental amplitude 2.5V, second harmonic amplitude of 0.5V, third harmonic amplitude of 0.1V.
(A) 20.40% (B) 10.20%
(C) 4.16% (D) 16%

27.



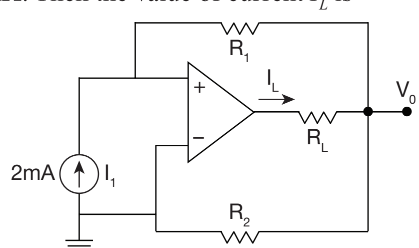
If V_{BE1} = 0.7V, V_{BE2} = 0.3V and β = 100. Then the current flowing through the load resistor R_L would be
(A) 3.7 mA (B) 2.5 mA
(C) –2.5 mA (D) 3.5 mA

28. The transistors in the circuit of figure have parameters V_{TN} = 0.3 V, K_n = 50 μA/V² and λ = 0. The width – to – length ratio of M_2 is $\left(\frac{W}{L}\right)_1$ = 2. If V_0 = 0.5V, when V_{in} = 5 V. Then $\left(\frac{W}{L}\right)_2$ is



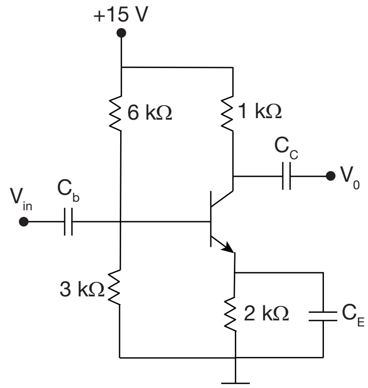
(A) 15 (B) 16.8
(C) 2.38 (D) 1.6

29. For the circuit shown below, if $R_1 = 1.5k\Omega$, $R_2 = 3k\Omega$, and $R_L = 2k\Omega$. Then the value of current I_L is ——— .



(A) 6 mA (B) 2 mA
(C) –2 mA (D) 4 mA

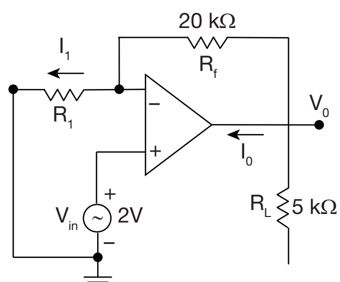
Common data for Questions 30 and 31:
The circuit shown in figure, uses silicon transistor having $\beta = 99$.



30. Find the operating point of the given circuit.
(A) $V_{CE} = 8.643$ V, $I_C = 2.1$ mA
(B) $V_{CE} = 7.125$ V, $I_C = 1.8$ mA
(C) $V_{CE} = 7.5$ V, $I_C = 2.1$ mA
(D) $V_{CE} = 8.643$ V, $I_C = 2.5$ mA

31. The stability factor is
(A) $S = 1.5$ (B) $S = 1.75$
(C) $S = 1.98$ (D) $S = 2.5$

Statement for Linked Answer Questions 32 and 33:



32. If $i_1 = 0.5$ mA, the output voltage V_o and input impedances are respectively
(A) 12 V, 4 kΩ
(B) +10 V, 1 kΩ
(C) –10 V, 4 kΩ
(D) –12 V, 1 kΩ

33. The current I_0 is
(A) 2.9 mA
(B) 2.5 mA
(C) –2.5 mA
(D) –2.9 mA

Statement for Linked Answer Questions 34 and 35:
When a negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 60.

34. The fraction of the output voltage feedback is
(A) $\frac{60}{100}$ (B) $\frac{1}{150}$
(C) $\frac{1}{140}$ (D) $\frac{100}{120}$

35. If the cut – off frequencies are $f_1 = 1.5$ KHz and $f_2 = 250$ KHz, then the bandwidth of the amplifier with negative feedback is
(A) 416 KHz
(B) 410 KHz
(C) 147.5 KHz
(D) 295 KHz

ANSWER KEYS

1. B	**2.** A	**3.** A	**4.** D	**5.** A	**6.** D	**7.** A	**8.** C	**9.** A	**10.** C
11. C	**12.** C	**13.** C	**14.** C	**15.** D	**16.** A	**17.** D	**18.** A	**19.** B	**20.** D
21. C	**22.** A	**23.** C	**24.** D	**25.** A	**26.** A	**27.** D	**28.** B	**29.** A	**30.** A
31. C	**32.** A	**33.** D	**34.** B	**35.** A					

HINTS AND EXPLANATIONS

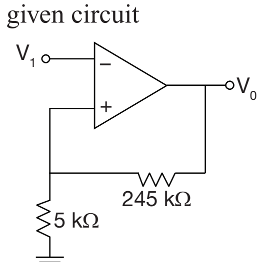
1. Ideal VCCS
$R_{in} = \infty$
$R_0 = \infty$
But practical case
R_{in} & R_0 are very large values. Choice (B)

2. Choice (A)

3. $A_v = \dfrac{g_m.R_D}{1+g_m.R_S}$; for R_s un by passed $[R_s \neq 0]$

$$A_v = \frac{4\times10^{-3}\times2\times10^{3}}{1+4\times10^{-3}\times0.5\times10^{3}} = \frac{8}{3} = 2.66$$ Choice (A)

4. Redrawing the given circuit



But $V_1 = 2$V, because voltage follower
$O/P = V_0 = V_1 = 2$V

$\therefore \quad V+ = V-$

$V_1 = V_0 \times \frac{5}{250}$

$V_0 = 5V_1 = 10$ V Choice (D)

5. Choice (A)

6. From the given data

$t_r = 0.75\mu$ sec

$t_r = \frac{0.35}{BW}$

$BW = \frac{0.35}{0.75} \times 10^6$

$BW \approx 467$ KHz Choice (D)

7. From the given data

$N = 100$ mV

$A = 250$

$\beta = \frac{1}{50}$

$1 + A\beta = 1 + \frac{250}{50} = 6$

$N_f = \frac{N}{1 + A\beta}$

$N_f = \frac{100mV}{6} = 16.66$ mV Choice (A)

8. Push – Pull amplifier contains only odd harmonics at the O/P, all the even harmonics are cancelled. The most effective in distortion is third harmonics $3f$, it has highest amplitude among all odd components. Choice (C)

9. Applying virtual GND concept

Let $V+ = V- = V_a$

$\therefore \quad V_0 = \left[1 + \frac{R_f}{R_1}\right].V_a$

$V_0 = 6V_a$

Apply nodal analysis at node $V+$ or V_a

$\frac{V_a - 2}{1} + \frac{V_a - V_2}{2} + \frac{V_a}{4} = 0$

$4[V_a] - 8 + 2V_a - 2V_2 + V_a = 0$

$7V_a = 8 + 2V_2$

$V_a = \frac{V_0}{6} = 2$

$14 - 8 = 2V_2$

$V_2 = 3$ Volts Choice (A)

10. From the given figure

At $f = 50$Hz, gain $= 75dB$

$A_{v_{\text{inds}}} = 20\log_{10} A_v$

$20\log_{10} Av = 75$

$A_v = 10^{3.75} = 5623$

$\therefore \quad f_T = B.\ W \times A_v$

$= 50 \times 5623 = 281$ KHz Choice (C)

11. The given circuit represents a inverting summing amplifier

$\therefore \quad V_0 = \frac{-R_f}{R_1}.V_1 - \frac{R_f}{R_2}.V_2 - \frac{R_f}{R_3}.V_3$

$\therefore \quad V_0 = -\{6 \times 2 + 3 \times (-3) + 2 \times 1\}$

$= -\{12 - 9 + 2\} = -5$ Volts. Choice (C)

12. Choice (C)

13. Form the given circuit

$\frac{V_0}{5K\Omega} = 2$ mA

$V_0 = 10$ V Choice (C)

14. Voltage regulation is given by

$\%V.\ R = \frac{V_{NL} - V_{FL}}{V_{FL}} \times 100$

$= \frac{50 - 45}{45} \times 100 = 11.11\%$ Choice (C)

15. At low frequencies

Inductor acts as a short circuit and capacitor open circuit.

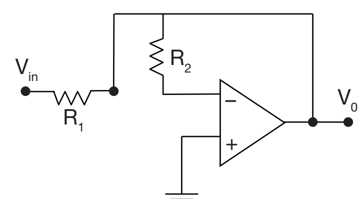
$\therefore \quad \frac{V_0}{V_{in}} = -\frac{R_2}{R_1}$

At high frequency $f \rightarrow \infty$Hz

$C \rightarrow$ Short circuit

$L \rightarrow$ Open circuit

The given circuit becomes

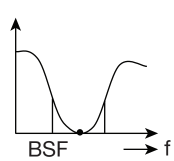


$\frac{V_0 - V_{in}}{R_1} + \frac{V_0}{R_2} = 0$

$V_0\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{V_{in}}{R_1}$

$V_0 \frac{(R_2 + R_1)}{R_1 R_2} = \frac{V_{in}}{R_1}$

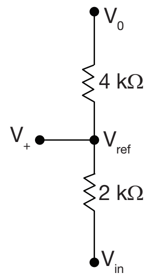
$\frac{V_0}{V_{in}} = \left(\frac{R_2}{R_1 + R_2}\right)$



{$\therefore$ The O/P existing at low & higher frequency range.

$\therefore$ It indicates Band stop filter. Choice (D)

16. Redrawing the given circuit



Applying nodal analysis at node V_{ref}

$$\frac{V_{ref}-V_0}{4}+\frac{V_{ref}-V_{in}}{2}=0$$

$V_{\text{ref}} - V_0 + 2(V_{\text{ref}} - V_{in}) = 0$

$3V_{\text{ref}} - V_0 = 2V_{in}$

$$V_{in}=\frac{1}{2}[3V_{ref}]-\frac{V_0}{2} \qquad \text{——(1)}$$

if

$\therefore \quad V_0 = +V_{sat} = 15\text{V}$

$V_{in} = V_x$

$V_x = 1.5\,(-2) - 7.5$

$= -10.5$ volts

If $\quad V_0 = -V_{sat} = -15\text{V}$

Let $V_{in} = V_y$

$V_y = -3 + 7.5 = 4.5$ volts

$\therefore$ upper threshold voltage

$V_{UT} = 4.5$ V and

$V_{LT} = -10.5$ V

Choice (A)

17. The given circuit represents an integrator

$$\therefore \quad V_0=\frac{-1}{RC}\int V_{in}.dt$$

$$V_0=\frac{-1}{100\times10^3\times10^{-5}}\int[5+1.5t^2]dt$$

$$=-\int\left[5+\frac{3}{2}.t^2\right]dt$$

$$=-\left[5t+\frac{3}{2}.\frac{t^3}{3}\right]=-\left|5t+\frac{t^3}{2}\right|$$

At $t = 0.5$ sec

$$V_0=-\left[\frac{5}{2}+\frac{1}{16}\right]=-2.5625 \text{ Volts}$$

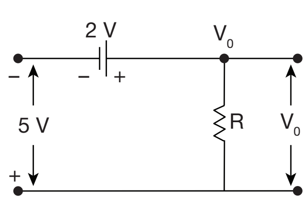
Choice (D)

18. If diode $D \to$ OFF

$V_0 = 0\text{V}$

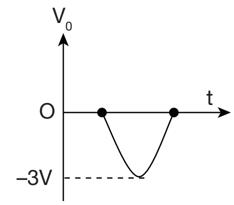
Diode $D \to$ ON only when

$V_{in} \le -2$ V



Applying input loop $-5 + 2 - V_0 = 0$

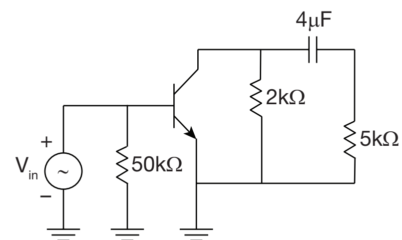
$V_0 = -3\text{V}$



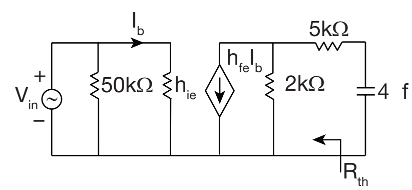
Choice (A)

19. For A. C analysis deactivate all the D. C. Sources.

$\therefore \quad V_{CC} \to$ GND



The hybrid equivalent model of given circuit is



We know $\omega = \dfrac{1}{\tau} = \dfrac{1}{R_{th}.C}$

But $R_{th} = (5k + 2k) = 7$ kΩ

$C = 4\mu\text{F}$

$$f=\frac{1}{2\pi RC}=\frac{1}{2\pi\times7\times10^3\times4\times10^{-6}}=5.68\text{Hz}$$

Choice (B)

20. $f_T = \dfrac{g_m}{2\pi\{C_{gs}+C_{gd}\}}$

$I_D = k_n\{V_{GS} - V_{TN}\}^2$

$g_m = \dfrac{\partial_D}{\partial V_{GS}} = 2\text{K}_n[V_{GS} - V_{Tn}]$

$g_m = 2 \times 0.5 \times 2\mu\text{AV}^2$

$= 2\text{mA/V}^2$

$\therefore \quad f_T = \dfrac{2\times10^{-6}\times10^{12}}{2\pi\{0.25\}} = 1.273$ MHz

Choice (D)

21. Applying KVL to the input loop

$5 - I_E R_E - 0.7 - R_B I_B - 2.5 = 0$

$I_B = 7.14\mu A$

Applying KVL to the O/P loop.

$I_C = \dfrac{5-0}{5}$ mA

$I_{Csat} = 1$ mA

$I_{cactive} = \beta \, . \, I_{Bactive}$
$= 75 \times 7.14 \times 10^{-6}$A
$= -0.5355$ mA
$I_{Cactive} < I_{csat}$
$\therefore$ Transistor is in active mode. Choice (C)

22. We know
$f = 1/\tau$
$\tau = R_{eq} . C_{eq}$
$\therefore$ $R_{eq} = (10 + 15)$ kΩ $= 25$ kΩ
$C_{eq} = 2$ μF
$R_{eq} . C_{eq} = 50$ m sec
$f = \frac{1000}{50}$ Hz $= 20$ Hz Choice (A)

23. Class A: Most stable biasing circuit
Operating point is in the mid of DC load line
Class B: Operations point is at the cut – off region.
Class C: Operating point is below cut off region and this is suitable for resonant frequency
Class D: Highest efficiency among all power amplifiers and transistor used in this act as switch. It operates in saturation and cut – off. Choice (C)

24. During $+Ve$ half cycle $D \rightarrow$ ON
$-Ve$ half cycle $D \rightarrow$ OFF
t indicates half wave rectifier
$\therefore$ $I_{avg} = \frac{l_m}{\pi}$

But $I_m = \frac{V_m}{R_f + R_L} = \frac{4}{3.25}$ mA $= 1.23$ mA

$I_{avg} = \frac{1.23}{\pi}$ mA $= 0.39$mA

$I_{rms} = \frac{l_m}{2} = 0.615$ mA Choice (D)

25. $V_0 = A_d \, V_d + A_c . \, V_c$
$V_0 = A_d V_d \left(1 + \frac{A_c}{A_d} . \frac{V_c}{V_d}\right)$ volts

But CMRR $= \frac{A_d}{A_c}$

$V_0 = A_d . V_d \left\{1 + \frac{1}{CMRR} . \frac{V_c}{V_d}\right\}$

From the given data
$A_d = 2000$; $V_{i1} = 150$μV; $V_{i2} = 110$μV
CMRR = 80
$V_d = \{V_{i1} - V_{i2}\} = 40$μV
$V_C = \frac{1}{2}\{V_{i1} + V_{i2} = 130$μV

$V_0 = 2 \times 10^3 \times 4 \times 10^{-5} \left\{1 + \frac{1}{80} \times \frac{130}{40}\right\}$

$V_0 = 83.25$ mV Choice (A)

26. $\%n^{th}$ harmonic distortion $= \%D_n = \left|\frac{A_n}{A_1}\right| \times 100\%$,

Total harmonic distortion
$= \sqrt{D^2{}_2 + D^2{}_3 + ... + D^2{}_n \times 100\%}$

$D_2 = \frac{0.5}{2.5} = 0.2$

$D_3 = 0.04$
T. H. D% $= \sqrt{(0.2)^2 + (0.04)^2 \times 100\%}$
$= \sqrt{0.04 + 1.6 \times 10^{-3}} \times 100\%$
THD = 20.40% Choice (A)

27. From the given circuit
Applying KVL to the output loop
$V_0 - V_z - V_{BE2} - V_{BE1} = 0$
$\therefore$ $V_0 = V_Z + V_{BE1} + V_{BE2}$
$= 6 + 0.7 + 0.3 = 7$ V
But $I_L = \frac{V_0}{R_L} = \frac{7}{2}$mA

$i_L = 3.5$ mA Choice (D)

28. For M_2 transistor
$V_{GS2} = 5 - 0 = 5$ V
$V_{DS2} = \text{V}_0 = 0.5$ V
$\therefore$ $V_{DS2} < V_{GS2} - V_T$
$\therefore$ M_2 is in non saturation region given $V_T = 0.3$V
For M_1 transistor
$V_{GS1} = 5 - V_0 = 5 - 0.5 = 4.5$ V
$V_{DS1} = 5 - V_0 = 4.5$
$V_{GS} - V_T = 4.5 - 0.3 = 4.2$
$V_{DS1} > V_{GS1} - V_T$
M_1 in saturation region
$\therefore$ $V_{DS1} = 4.5 > 4.2$V
$\therefore$ M_1 in saturation region

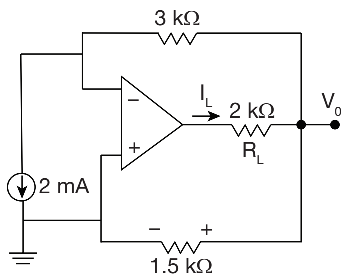
$$K_n^1 \times \left(\frac{W}{L}\right)_1 [V_{GS1} - V_T]^2 = K_n^1 \left(\frac{W}{L}\right)_2$$

$$[(V_{GS2} - V_T)V_{DS2} - V_{DS}{}^2]$$

$$2 \times 17.64 = \left(\frac{W}{L}\right)_2 \times [4.7 \times 0.5 - 0.25]$$

$$\left(\frac{W}{L}\right)_2 = \frac{35.28}{2.1} = 16.8$$ Choice (B)

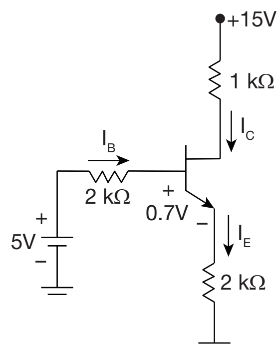
29. Redrawing the given circuit
Applying virtual GND concept
So $V+ = V- = 0V$
$0 + 2 \times 3 - V_0 = 0$
$V_0 = 6$V
$i_L = i_{R1} + i_{R2}$
$i_{R1} = \frac{V_0}{1.5}$ mA $= \frac{6}{1.5}$ mA



$i_{R1} = 4$ mA
$i_{R2} = 2$ mA
$i_L = 6$ mA $= i_{R1} + i_{R2}$ Choice (A)

30. $V_{th} = 15 \times \frac{3}{9} = 5$ V

$R_{th} = (6k \| 3k) = 2$ kΩ
Redrawing the given circuit



$$I_B = \frac{5-0.7}{2k+100\times 2k} = \frac{4.3}{202} \text{ mA} = 21.287\mu\text{A}$$

$I_C = \beta \,.\, I_B = 99 \times 21.287 \times 10^{-6} = 2.1$mA
Applying KVL to the output loop
$V_{CE} = V_{CC} - I_C R_C - I_E R_E$
$= 15 - 2.1 - 4.257$
$= 8.463$ Volts
Operating point
$(V_{CE}, I_E) = (8.643\text{V}, 2.1 \text{ mA})$ Choice (A)

31. We know stability factor

$$S = \frac{1+\beta}{1-\beta.\frac{\partial_B}{\partial_C}}$$

Applying KVL to the input loop
$V_{th} - I_B \,.\, R_B - V_{BE} - I_E R_E = 0$
$V_{th} = I_B R_B + V_{BE} + I_B R_E + I_C . R_E$
Differentiating both sides w. r. t I_C

$$0 = \frac{\partial_B}{\partial_C} R_B + 0 + \frac{\partial_B}{\partial_C}.R_E + R_E$$

$$\therefore \quad S = (1+\beta)\times \frac{1}{1+\beta\left(\frac{R_E}{R_B+R_E}\right)}$$

$$S = \frac{100}{1+99\times\left[\frac{2k}{4k}\right]} = 1.98$$ Choice (C)

32. From the given data

$$i_1 = \frac{V_0 - V_{in}}{R_f}$$

$V_0 = i_1 R_f + V_{in}$
$= 0.5 \times 20 + 2$
$= 12$ Volts

And input impedance $R_{in} = R_1 = \frac{V_{in}}{i_1}$

$R_1 = \frac{2}{0.5}$ kΩ $= 4$ kΩ Choice (A)

33. From the given data
Applying KCL at output loop $i_L + i_0 + i_1 = 0$
$i_0 = -i_1 - i_L$

$$= \left(0.5\times 10^{-3} - \frac{12}{5}\right)\text{mA}$$

$I_0 = -2.9$ mA Choice (D)

34. From the given data $A_v = 100$ & $A_{vf} = 60$

We know $A_{vf} = \frac{A_v}{1+A_v.\beta}$

$$60 = \frac{100}{1+100.\beta}$$

$$1 + 100\beta = \frac{2}{3}$$

$\beta = \frac{1}{150}$ Choice (B)

35. For a '– *ve*' feedback amplifier, BW increases

$\therefore \quad f_1^1 = \frac{f_1}{1+A_v\beta}$; $f^1_2 = f_2(1 + A_v\beta)$

$$f^1_1 = \frac{1.5\text{KHz}}{\left(\frac{5}{3}\right)} = 0.9\text{KHz}$$

$$f^1_2 = 250\times\left(\frac{5}{3}\right)\text{KHz}$$

$= 416.66$ KHz
$BW_f = f^1_2 - f^1_1 = 415.766$ KHz
$BW_f \approx 416$ KHz Choice (A)