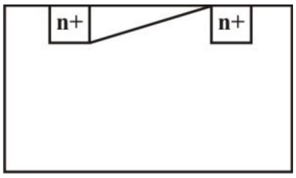
Analog Objective Solution (ESE-2015 Test Series Dated 27.03.2015)

1. (B) For BJT, we refer $V_{CE,Sat} = 0.2$ i.e voltage becomes very low for switch, it enters into saturation. Such power dissipation becomes very small. So we prefer CE Mode.

2. (B)



In case of MOS, at high electric field, mobility is not independent of E but it becomes function of $\mu \,\alpha\, E^{-1} \Rightarrow \mu E = \text{constant}$

$\therefore$ Velocity becomes saturated.

$\therefore$ I_D becomes constant.

3. (C) $r_\pi = \dfrac{h_{fe}}{g_m},\ g_m = \dfrac{I_C}{V_T}$

$\therefore$ $r_\pi \;\alpha\; T$ Also we know that: $\beta \;\alpha\; T$

$C_e + C_C = \dfrac{g_m}{2\pi f_T}$ $\therefore$ $C_\pi = \dfrac{g_m}{2\pi f_T}$

$C_\pi \;\alpha\; \dfrac{1}{T}$

4. (C) $\eta = \dfrac{P_o(ac)}{P_i(dc)}$ $P_i(dc) = \dfrac{P_o(ac)}{\eta} = \dfrac{157}{\le 0.785}$

$P_i(dc) \ge 200\,\text{mW}$

5. (B) $5 = 4.3 I_x + 0.7$

$I_x = \dfrac{4.3}{4.3} = 1\text{mA}$

6. (C) $A_{OL} = 2 \times 10^5$

$V_o = 3 \times 2 \times 10^5 = +V_{Sat} = +16\text{V}$

7. (C)

8. (B) Example of Current – Shunt $\therefore$ Shunt – Series

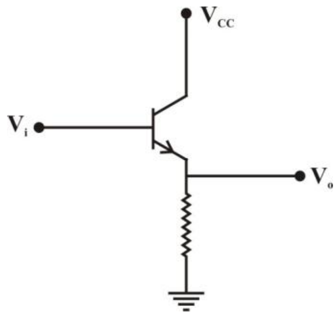
9. (A) $R_i = R_1 = 1\Omega$ $\dfrac{R_f}{R_i} = 50$ $\therefore$ $R_f = 50\,\text{k}\Omega$

10. (A) –180º phase shift two times.

11. (B) $A_I = \dfrac{h_{fe}}{1 + h_{oe} R_L}$

$R_L \uparrow,\ A_I \downarrow$

12. (C)



Does not affect input impedance or voltage gain or current gain.

13. (A) $r_o = \frac{V_A}{I_E} = \frac{10V}{1mA} = 10\ k\Omega$

without degradation -without any feedback.

14. (C) $f_H = \frac{1}{2\pi R_i C_i}$

At high frequency $R_i \downarrow$

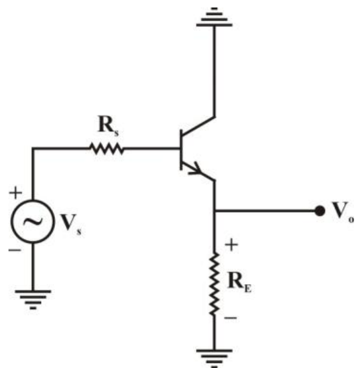
$C_i = C(1 - A_v)$

$f_H \uparrow$.

$\therefore$ For high frequency range: $CB > CC > CE$ .So f_H value will increase.

It does not provide current gain as it behaves like a constant current source.

15. (C)



Any device which has high input impedance and low output impedance can be used as buffer.

It has –ve feedback.

16. (B) $V_o = \left(1 + \frac{R_f}{R_1}\right) V_{os} + R_f\ I_{os}$

V_{os} = offset voltage

I_{os} = offset current

$479 = \left(1 + \frac{500}{5}\right) 4 + 500\, I_{os} \quad \Rightarrow \quad 75 = 500\, I_{os}$

$I_{os} = \frac{75 \times 10^{-3}}{500 \times 10^{3}} = 150\, nA$

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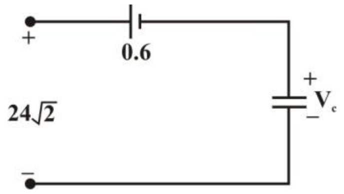
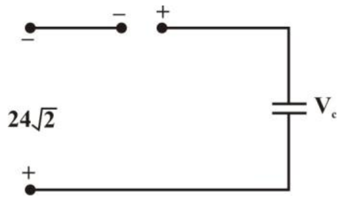
17. (B) $V_m = 24\sqrt{2}$



In +ve half;

$V_c = 25\sqrt{2} - 0.6$

In –ve half;



$24\sqrt{2} + V_D + V_C = 0$

$V_D = -48\sqrt{2} + 0.6 \quad = -67.282\,V$

18. (A) $R_i = 2(R_s + h_{ie}) \leftarrow$ Input impedance (for any configuration)

$$\left.\begin{array}{l} DIBO \to R_c/r_e \\ DIUO \to R_c/2r_e \\ SIBO \to R_c/r_e \\ SIUO \to R_c/2r_e \end{array}\right\} \text{Differential gain}$$

$$r_e = \frac{V_T}{I_E}, \; h_{ie} = \beta r_e$$

$$h_{ie} = \beta r_e = \frac{\beta \times V_T}{I_{EQ}}$$

$$= \frac{50 \times 25}{1mA}$$

$$R_i = 2(R_s + h_{ie})$$

$$= 2(0 + 1250) = 2500\,\Omega$$

$$= 2.5\,k\Omega$$

19. (A) $\frac{V_o}{v_i} = -\frac{1}{SC_1R_1} \;\Rightarrow\; 15 = \frac{1}{\omega R_1 C_1}$

$R_1C_1 = 10\,ns$

$$\omega = \frac{1}{15 \times 10 \times 10^{-9}} \quad = 6.66\,MHz\;[Rad/sec]$$

20. (C) It is example of double cascoding.

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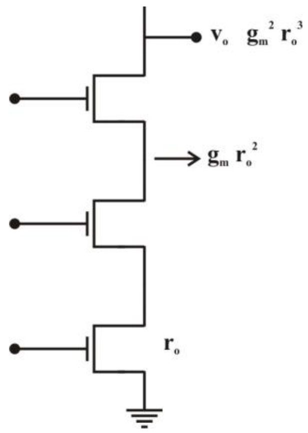

21. (C) In case of power amplification, value of collector current is high.
So, there will be more power dissipation. Hence, collector size will be large.
To give large value of load current, o/p impedance should be small.

22. (B) $R_i = h_{ie} = \beta r_e = \beta \frac{V_T}{I_E} = \frac{100 \times 25}{1} = 2500\,\Omega$

23. (D) $\frac{V_o}{V_i} = \frac{-h_{fe} R_c}{h_{ie} + (1 + h_{fe}) R_e}$

$\simeq -\frac{R_c}{R_e}$

$= -\frac{5}{0.1} = -50$

24. (A) $A_v = -\frac{R_c \times \beta}{h_{ie}}$ $\quad r_e = \frac{25}{10}$

$= -\frac{R_c}{r_e} = -\frac{5}{2.5} = -2$

25. (A) At low frequency, $L_f \rightarrow$ shorted.
R_f will give –ve feedback
$\therefore$ Gain Reduces $\therefore$ Bandwidth increases.

26. (B)

27. (B) $I_D = k\left[2\left(V_{Gs} - V_T\right)V_{Ds} - V_{Ds}^2\right] \rightarrow$ In linear region
$\therefore$ Quadratic.

28. (C) Prevents negative feedback.
Provides high pass response.
By using emitter bypass capacitor, –ve f/b is prevented. So gain is increased, so BW will decrease. It means it will operate in low frequency region and hence, response will be high pass.

29. (D) No. of zeros = No. of stages in transfer function

30. (C) Current mirror circuit behaves like a constant current source.
I.e. its interval resistance becomes infinite. Hence it will increase the input resistance.

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31. (D) In case of class-B, it will remain in cut-off so, if no I/P is given, than no power dissipation and this power dissipation increase with increase in I/P.

32. (B) $V_o = A_d V_d + A_c V_c$

$V_d = 100\,\mu V \quad V_c = 1000\,\mu V$

$$CMRR = \frac{A_d}{A_c} = 1000$$

$V_o = A_d V_d$ — (i) $= 100 A_d$

$V_o = A_d V_d + 10^{-3} A_d \times 10^3$

$= A_d V_d + A_d = 101 A_d$ — (ii)

So, error is 1%

$$Error = \frac{101 A_d - 100 A_d}{100 A_d} \times 100\% = 1\%$$

33. (C)

34. (B) Gain $\uparrow$, BW $\downarrow$

$f_L \uparrow$ and $f_H \downarrow$

{Improve f_L (low frequency response) means increase value of f_L}

35. (A)

36. (B) at $f = f_H$, phase shift = $\phi = -45^o$

$\phi_T = 180 - 45 = 135^o$

at $f = f_L$; $\phi = +45^o$

$\phi_T = 180 + 45 = 225^o$

37. (D) Negative feed-back $\Rightarrow$ Always stable

38. (B) $\left(\frac{A_o}{2}\right)^3 \angle 180^o \times 0.008 = 1$

$A_o = 10$

$|\beta A_o| = 1$

$\beta A_o = -1$

$\beta = +ve \quad \therefore A_o = -10$ For 180^o phase shift

39. (A) T = 0.69 RC $\rightarrow$ Mono stable multi-vibrator

40. (A) Statement (2) is wrong as in class B, there are chances of cross-over distortion.

41. (A) Centre Tap transformer.

$\therefore \quad V_{rms} = 50 \quad V_m = 50\sqrt{2} \quad PIV = 2V_m = 100\sqrt{2}$

42. (D)

43. (B) $R_i = h_{ie} + (1 + h_{fe}) R_e$

For high value of R_i; R_e should be high.

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For higher value of I/P impedance, R_e should be high but it requires large value of V_{cc}.

44. (B)

45. (A)

46. (B)

47. (A) In RF oscillators, there is voltage series +ve feedback.

$\therefore$ Series-shunt

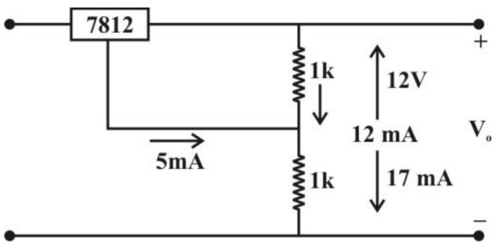
48. (D)

49. (A)

50. (C) $I_m = \frac{V_m}{R_f + R_L} = \frac{325}{0.1+1} = 295.45$

$I_{rms} = \frac{I_m}{2} = 147.7\,mA$

51. (D)



$V_o = 12 + 1k(17\,mA) = 29$ V

52. (A) $f_H = \frac{1}{2\pi r_{b'e}(C_\pi + C_\mu)}$, $r_{bb'} + r_{b'e} = h_{ie} \rightarrow (\text{constant})$

For $f_H \uparrow$; $C_\pi + C_\mu \downarrow$ $h_{ie} = \beta r_e$

and $r_{b'e} \downarrow$ $r_{bb'} = (\beta - 1) r_e$

53. (D) $T_H = (R_A + R_B)C$

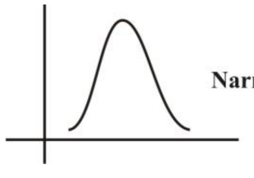
$T_L = R_B C$

54. (A)

55. (D) $\tau = 0.69\,RC$

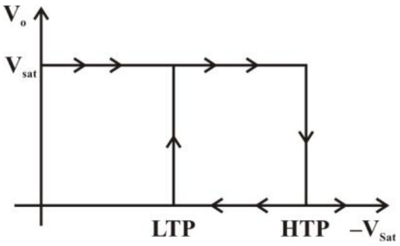
56. (C)

57. (C)



58. (B) Video amplifier works in narrow frequency range.

59. (C)



Hysteresis reduces affects of noise.

Hysteresis is desirable phenomenon in Schmitt trigger because it prevent noise from false triggering. For example: If $U_{LTP} = 1V$ and $U_{LTP} = -1V$ $\{V_H = 2V\}$

Then Schmitt trigger has immunity to false triggering as long as peak to peak noise voltage is less than 2V.

60. (D)

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