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10. a) Ib = (Vcc – Vbe) / Rb + (β+1)Re

= (22 – 0.7) / 330 k + 81 x 1.67 k

= 21.3 / 465.27 k

= 45.7 µA

Ie = (β+1)Ib

= 81 x 45.7 µ

= 3.7 mA

re = 26 mV / Ie

= 26 mV / 3.7 mA

= 7.03 Ω

b) Zb = β(re + Re)

= 80(7.03 + 1.67 k)

= 134.162 kΩ

Zi = Rb||Zb

= 330 k||134.162 k

= 95.39 kΩ

c) Ai = βR’ro / (ro + Rc)(R’ + βre)

= (80)(1.67 k)(40 k) / (40 k + 5.6 k)(1.67 k + 80x7.03)

= 249.35

11. a) Ib = (Vcc – Vbe) / Rb + (β+1)Re

= (16 – 0.7) / 270 k + (110 + 1) 2.7 k

= 15.3 / 270 k + (111 x 2.7 k)

= 15.3 / 270 k + 299.7 k

= 26.8 µA

Ie = (β + 1)Ib

= 111 x 26.8 µ

= 2.9 mA

re = 26 mV / Ie

= 26 mV / 2.9 mA

= 8.96 Ω

Βre = 110 x 8.96

= 985.6 Ω

b) Zb = βre + (β+1)Re

= 985.6 + (111 x 2.7 k)

= 300.68 kΩ

Zi = Rb||Zb

= 270 k||300.68 k

= 142.26 kΩ

Zo = Re||re

= 2.7 k||8.96

= 8.93 Ω

c) Av = Vo / Vi

= Re / Re + re

= 2.7 k / 2.7 k + 8.96

= 0.996

Ai = -Av Zi / Re

= -(0.996)(142.26 k) / 2.7 k

= -52.47

12. a) Ib = (Vcc – Vbe) / Rb + (β+1)Re

= (12 – 0.7) / 390 k + (121 x 5.6 k)

= 11.3 / 1067.7 k

= 10.5 µA

Ie = (β+1)Ib

= 121 x 10.5 µ

= 1.27 mA

re = 26 mV / Ie

= 26 mV / 1.27 mA

= 20.47 Ω

ro >= 10Re

40 kΩ >= 10(5.6 kΩ)

40 kΩ >= 56 kΩ

Zb = βre + ((β+1)Re / 1+(Re/re))

= 120 x 20.47 + ((121 x 5.6 k) / 1+ (5.6 k/ 40 k))

= 2.456 k + (677.6 k / 1.14)

= 2.456 k + 594.385 k

= 596.841 k

Zi = Rb||Zb

= 390 k||596.841 k

= 235.87 kΩ

Zo = Re||re

= 5.6 k||20.47

= 20.39 Ω

b) Av = ((β+1)Re/Zb) / (1+ (Re/ro))

= (121 x 5.6 k / 596.841 k) / (1+(5.6 k / 40 k))

= 1.13 / 1.14

= 0.991

c) Vo 🡪 Vi = 1 mV

Av = Vo / Vi

0.991 = Vo / 1 mV

Vo = 0.991 x 1 mV

= 0.991 mV

13. a) Ib = Vcc – Vbe / Rb + (β+1)Re

= 20 – 0.7 / 7.15 k + (201 x 2 k)

= 19.3 / 409.15 k

= 47.1 µA

Ie = (β+1)Ib

= 201 x 47.1 µA

= 9.46 mA

b) re = 26 mV / Ie

= 26 mV / 9.46 mA

= 2.74 Ω

c) Zb = βre + (β+1)Re

= (200 x 2.74) + (201 x 2 k)

= 548 + 402 k

= 402.54 kΩ

Zi = Rb||Zb

= 7.15 k||402.54 k

= 7.02 kΩ

Zo = Re||re

= 2 k||2.74

= 2.74 Ω

d) Av = Re / (Re + re)

= 2 k / 2 k + 2.74

= 0.998

Ai = -(AvZi) / Re

= -(0.998 x 7.02 k) / 2 k

= -7005.95 / 2000

= -3.5

14. a) Ie = Vee – Vbe / Re

= 6 – 0.7 / 6.8 k

= 0.77 mA

re = 26 mV / Ie

= 26 mV / 0.77 mA

= 33.76 Ω

b) Zi = Re||re

= 6.8 k||33.76

= 33.59 Ω

Zo = Rc

= 4.7 kΩ

c) Av = Rc / re

= 4.7 k / 33.76

= 139.2

Ai = -α

= -0.998

15. Ie = Vee – Vbe / Re

= 5 – 0.7 / 3.9 k

= 4.3 / 3.9 k

= 1.1 mA

re = 26 mV / Ie

= 26 mV / 1.1 mA

= 23.63 Ω

Av = Rc / re

= 3.6 k / 23.63

= 152.34

Ai = -β

= -75