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Chapter 7*&9*

2019.4.10

13:20-15:10am

1. (16%) Sketch the approximate Bode plot for the transfer function *T(s)* (include proper label of

*R*j = 10 k12

the frequencies, magnitudes and phases). 2x1045

(b) T*(s) = v./vi*

(*a) T*(S) = (5+102)(5+105)

Our

C; = 10*4F*

SR2 = 20 ks*2*

2. (18%) We want to design a MOSFET amplifier with the configuration in Figure 1. (a) Design *Rp*

such that Ip*e =* 0.2 mA and Vpse = 5 V. (b) The magnitude of the voltage gain should be -10 in the midband range, determine the required value of *Im* and Kn (assumingł = 0 and ignoring Rsi). (c) if midband frequency range from 200 Hz to 3 kHz, and *Rth = R*1||*R*2 = 50 kN, determine the required value of *C*c and *Cz.*

C*O*NNO

**U**

3. (18%) For the common-emitter circuit in Figure 2, assume that rs = 0, R1||R2 = 5kn, and

*Rc = Ry* = 1 k12. The transistor is biased at *Ice* = 5 mA and the parameters are *Bo* = 200, VA = *0, Cu* = 5 pF, and fr = 250 MHz (unity-gain bandwidth for short circuit current gain). (a) Determine the value of Cpt. (b) Determine the equivalent Millar capacitance. (c) Determine the upper 3dB frequency for the small-signal current gain.

VpD=9V

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SRO

ERC cc

3R

**??**

*R*si = 200 *$*2

*U;*

\*

W

{RE

CE

Figure 1

Figure 2

4. (10%) The inverting op-amplifier shown in Figure 3 has parameters *R*2 = 25 kN, *R2* = 100 kN,

and open-loop gain Aod = 10000. The input voltage is from an ideal voltage source whose

value is v; = 1 V. (a) Calculate the actual close-loop voltage gain. (b) What is the voltage at the

inverting input terminal of the op-amp?

5. (10%) For the circuit shown in Figure 4, (a) plot the voltage transfer characteristic curve of vo

(versus vi). (b) plot the voltage transfer characteristic curve of voi (versus vi).

**R**

*id*

-

R

mwa *VO*

Figure 3

Figure 4

S

6. (12%) For the circuit shown in Figure 5, (a) derive the voltage transfer function A, = v*o/V,* as

a function of frequency. (b) What is the voltage gain at dc? (c) At what frequency is the magnitude of the gain a factor of v2 less than the dc gain?

7. (16%) For the instrumentation amplifier in Figure 6, the parameters are *R4* = 90 kN,

*R3* = 30 kl, and *R2* = 50 kl. Resistance *R*4 is a series combination of a fixed 2 k*N2* resistor

and a 100 k1*2* potentiometer. (a) Determine the range of the differential voltage gain. (b) If one of the resistor R3, which is connected to the inverting terminal of A3, is Rs = 30 kN + 5%.

COT

Determine the CMRR.

*R*ok

Ri

R2

*NOW*

A3

R3

Figure 5

*Up-*

*1*42

di*as*

Figure 6