23-11-2018

MECE 347 Midterm

Name:

Surname:

Number:

Signature:

Q1) For the amplifier circuit below the transfer function is given as H(s)=$\frac{V\_{out}(s)}{V\_{in}(s)}=1000\frac{1}{(s+100)}$ in Laplace domain**.** This circuit acts as a low pass active filter**.** Select suitable values for R1, Rf, Rx and C to obtain the exact transfer function given as H(s). Choose your resistor values in M Ohms and **(31 points).**

 

Q2) We have 2 inputs which are named as V1(t) and V2(t). Design a circuit diagram that generates the output function $V\_{out}\left(t\right)=-2\frac{d^{2}}{dt^{2}}V\_{out}\left(t\right)+V\_{1}\left(t\right)-3V\_{2}\left(t\right).$ In your design you can use any number of amplifier units given in the figures below. However each unit should either demonstrate an inverting integrator or an inverting-summing amplifier characteristics or simple an inverting amplifier characteristics. Indicate gain value of each unit **(31 points).**

**Inverting Amplifier unit Inverting integrator Amplifier unit**

 
**Inverting Summing Amplifier unit**



Q3)A FET amplifier structure in small signal AC analysis is given below. This circuit is examined for low frequency range and it should have 3 cut of frequencies due to the capacitors Cg, Cd and Cs. Find approximately the cut-off frequency (fcut\_of\_Cd) due to capacitor Cd. In the calculations take r0=RL=RD=RS=1000 Ω, Cd= 1 μFarad, gm=10-3 Siemens. **(33 points). The procedure for finding** fcut\_of\_Cd is given below.

Procedure:

* Kill all sources
* Short the capacitors (Except for Cd)
* Put source instead of Cd (VTest)
* Calculate the current originating from the source (ITest)
* VTest/ITest=RCd
* fcut\_of\_Cd=$\frac{1}{2πC\_{d}R\_{Cd}}$



Q4) For an operational amplifier the slew rate is SR= 2 Volt/μsec. What is the maximum possible closed-loop voltage gain that can be used when the input signal varies by 0.5 Volt in 10 μsec. **(5 points).**