PhD Preliminary Written Exam Spring 2015, April 4, 2015 Problem 4 Analog and Digital Electronics Solution

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Small Signal Pavametors: gm = 2ID = 1mS ro = VAJD = 200KL - SAIT Transistors 9mro = 200 Minimum Vour: Vour = V7 + Vov. + Vov2 = 0.3+0.1+0.1 = 0.5V 2) Rour: Ignore roy and roy Vasi = Vasa -> M3 mirrors M1 These assumptions let us draw the following schematic: XT + gm2 V2 < Vo2 9mit Toz. INT LT 3mi

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17 = 9m2 12 + 17 - 17/9mi 1/2 = - 1- roz - 1-1/gmi This gives Rour = 1 = roz (1 + Jm, roz + roz gm2 + gm2) $= r_{02} + \frac{1}{gm_1} + r_{02} g_{m_2} \left(1 + \frac{1}{gm_2 r_{03}} \right) r_{03}$ E(Exact Answer)-1 $\frac{R_{04T}=2\times10^{5}+1000+200\left(1+\frac{1}{200}\right)2\times10^{5}}{=4.04\times10^{7}\Omega}$ often approximated as: RONT = roz (1+ gm2roz) = 4.02 × 10 1