

**Indian Institute of Technology, Delhi**  
**ELL304 Analog Circuits**  
**Tutorial 5, 27 August 2015**

Find the operating point of the MOSFETs in Figs 1, 2, 3, 4, 5, 6. Then perform small signal analysis and estimate the output impedance and the voltage gain the circuit. Find the voltage limits for symmetric swing at the output.

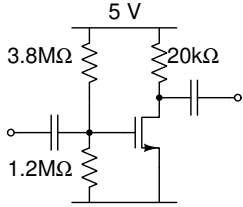


Fig 1

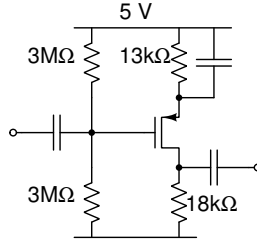


Fig 2

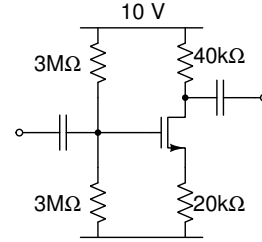


Fig 3

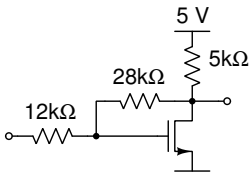


Fig 4

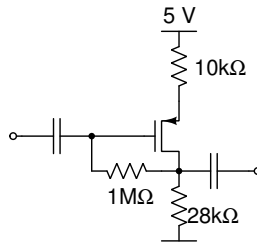


Fig 5

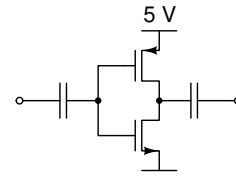


Fig 6

For the MOS devices, assume  $K_n = K_p = 2.5 \text{ mA/V}^2$ . Further assume  $|V_{T_p}| = V_{T_n} = 1 \text{ V}$ . For question 6 only, assume  $\lambda = 0.1 \text{ V}^{-1}$ . For all other questions assume  $\lambda = 0$ .