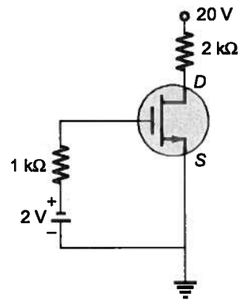
7 Small Signal Analysis of FET

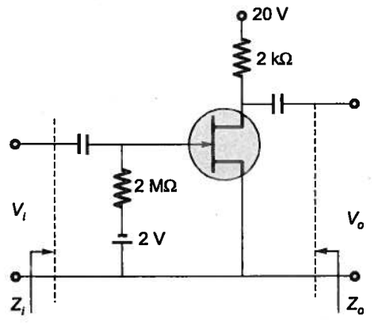
Multiple Choice Questions

Q.1 The value of V_{GS} and V_G for the circuit shown in figure is



(a) –2 V, –2 V (b) 2 V, –2 V
(c) 2 V, –2 V (d) –2 V, 2 V

Common Data Questions (2 to 4):
Given: $r_d = 20\ k\Omega$, $I_{DSS} = 10\ mA$, $V_p = -8\ V$

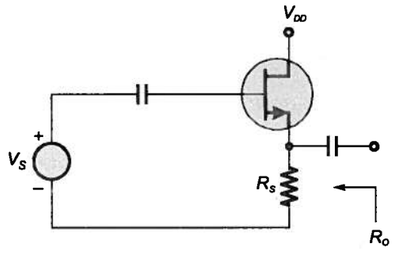


Q.2 Z_i and Z_o of the circuit are respectively
(a) 2 MΩ and 2 kΩ
(b) infinity and 2 MΩ
(c) 2 MΩ and 20/11 kΩ
(d) infinity and 20/11 kΩ

Q.3 I_D and V_{DS} under DC conditions are respectively
(a) 5.625 mA and 8.75 V
(b) 1.875 mA and 5 V
(c) 4.5 mA and 11 V
(d) 6.25 mA and 7.5 V

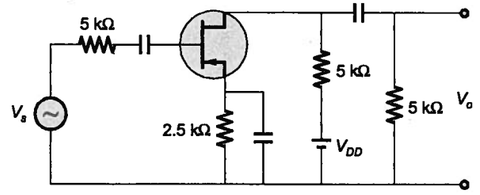
Q.4 Tranconductance in milli siemens (ms) and voltage gain of the amplifier are respectively
(a) 1.875 ms and 3.41
(b) 1.875 ms and –3.41
(c) 3.3 ms and –6
(d) 3.3 ms and 6

Q.5 For the circuit shown below if $g_m = 3 \times 10^{-3}$ and $R_s = 3000\ \Omega$, then what is the value of R_o?



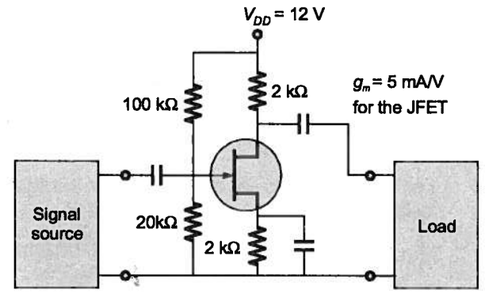
(a) 3000 Ω (b) 1000/3 Ω
(c) 300 Ω (d) 100 Ω
[ESE-2006 (EE)]

Q.6 Given $g_m = 2$ mA/V; $r_d \to \infty$. The voltage gain $|A_v| = \left|\frac{V_o}{V_S}\right|$ is given by



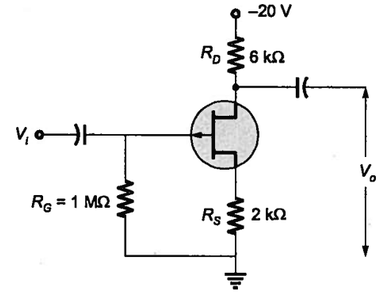
(a) $\frac{5}{3}$ (b) 5
(c) 10 (d) $\frac{10}{3}$

Q.7 The mid-frequency input impedance of the JFET amplifier given in figure lies in the range



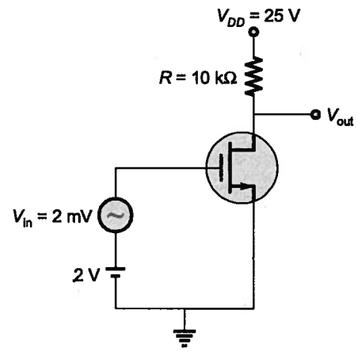
(a) 100-300 Ω (b) 1-3 kΩ
(c) 10-20 kΩ (d) 100-200 kΩ

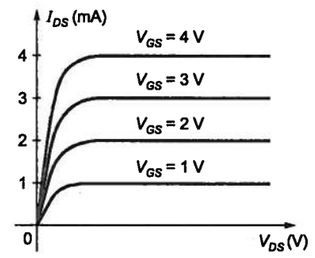
Q.8 Consider a JFET amplifier shown below:



If $g_m = 4000\ \mu\mho$ then closed loop gain of amplifier is given by
(a) 24 (b) 12
(c) 6.42 (d) 2.66

Common Data Questions (9 and 10):
Assume that that threshold voltage of the N channel MOSFET shown in figure is +0.75 V. The output characteristic of the MOSFET are also shown below:

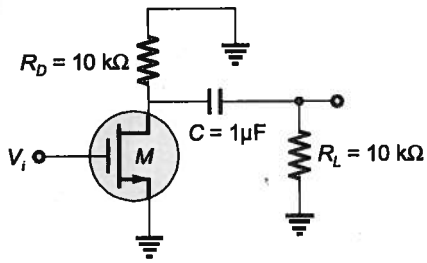




Q.9 The transconductance of the MOSFET is
(a) 0.75 ms (b) 1 ms
(c) 2 ms (d) 10 ms

Q.10 The voltage gain of the amplifier is
(a) +5 (b) –7.5
(c) +10 (d) –10

Q.11 The ac schematic of an NMOS common-source stage is shown in the figure below, where part of the biasing circuits has been omitted for simplicity. For the n-channel MOSFET M, the transconductance $g_m = 1$ mA/V, and body effect and channel length modulation effect are to be neglected. The lower cut-off frequency in Hz of the circuit is approximately is

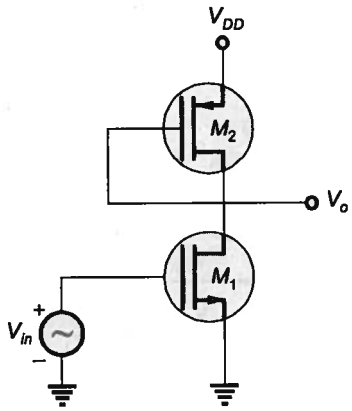


(a) 8 (b) 32
(c) 50 (d) 200

[GATE-2013]

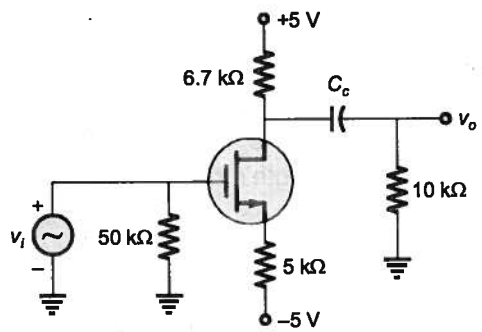
Numerical Data Type Questions

Q.12 In the figure shown below:



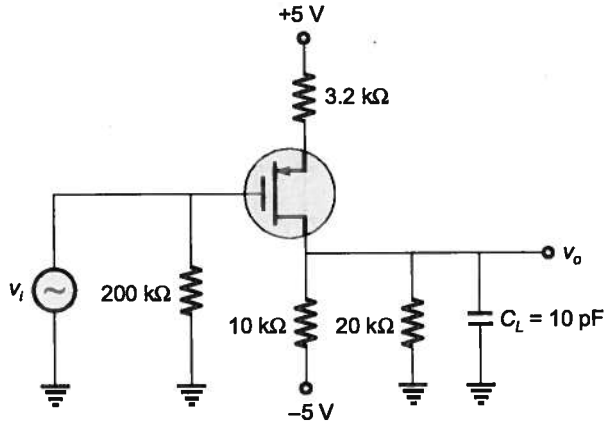
If $\mu_n = 1300\ cm^2/V\text{-}sec$; $\mu_p = 325\ cm^2/V\text{-}sec$, then the value of the (W/L) ratio $\left(i.e.\frac{(W/L)_1}{(W/L)_2}\right)$ to make it a unity gain inverting amplifier is _____. (Assume $V_A = \infty$)

Q.13 Consider the circuit shown below. If the lower corner frequency due to coupling capacitor C_C is $f_L = 20$ Hz, then the value of coupling capacitor C_c is _____ μF.



Q.14 Consider a circuit shown in figure below. The transistor parameters are

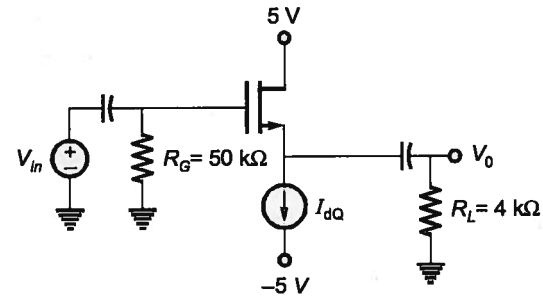
$V_{TP} = -2$ V
$K_p = 0.25\ mA/V^2$



The value of 3 dB corner frequency (in MHz) due to capacitor C_L is ____.

Try Yourself

T1. For the source follower circuit shown in the figure below, the transistor parameters are $V_T = 1$ V, $\frac{1}{2}\mu_n C_{ox} = 30\ \mu A/V^2$ and neglect channel length modulation. The small signal voltage gain to be $A_v = \frac{V_0}{V_i} = 0.95$. The value of $\left(\frac{W}{L}\right)$ ratio if $I_{dQ} = 4$ mA is



(a) 50 (b) 47
(c) 28 (d) 36