K. J. Somaiya Institute of Engineering and Information Technology, Sion, Mumbai-22

(Autonomous College Affiliated to University of Mumbai)

(DEC-21) Feb- 2022

Program: B.Tech E&TC

Examination: SY Semester: III

Course Code: 1UEX303 and Course Name: Electronic Devices and Circuits

Duration: 03 Hours Max. Marks: 60

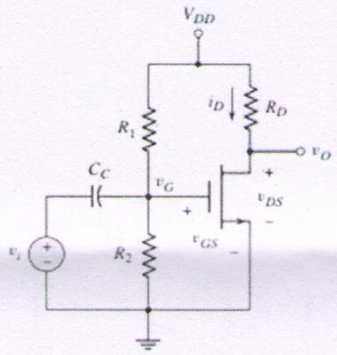
Instructions:

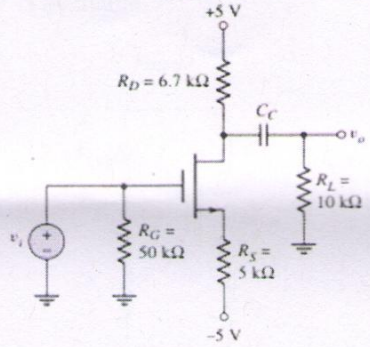
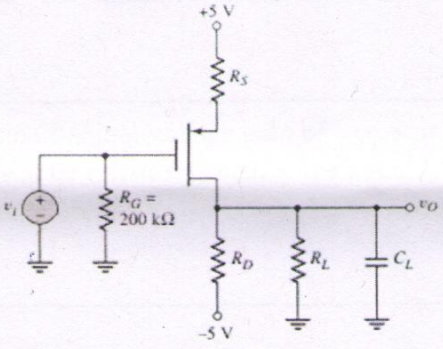
(1)All questions are compulsory.

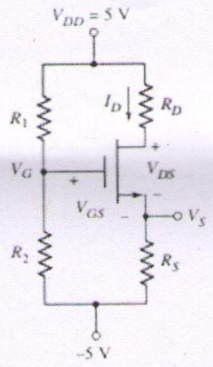
(2)Draw neat diagrams wherever applicable.

(3)Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	**Solve any six questions out of eight**	**12**		
i)	Illustrate Drain Characteristics of E-MOSFET with graph.	**2**	2	U
ii)	Derive for Transfer function of series coupling RC circuit.	**2**	2	U
iii)	Define diode current equation.	**2**	1	U
iv)	Illustrate ac equivalent model of MOSFET with circuit diagram.	**2**	1	U
v)	Define Channel Length Phenomenon in MOSFET.	**2**	1	U

vi)	Draw symbol of N- MOSFET and P- MOSFET	**2**	1	U
vii)	For a MOSFET circuit, If expression for I_D is $I_D = K_n(V_{GS} - V_{to})^2$ Then Derive for gm.	**2**	1	U
viii)	Define differential mode gain and common mode gain.	**2**	2	U
Q.2	**Solve any four questions out of six.**	**16**		
i)	Illustrate transfer characteristic with various region of operation using graph and current equation.	**4**	1	U
ii)	Explain the working of E- MOSFET with constructional detail	**4**	1	U
iii)	Compare low and high frequency ac model of MOSFET.	**4**	3	AP
iv)	MOSFET can act as current source. Justify the statement	**4**	3	AP
v)	Analyze circuit in given figure to find DC voltages and current.  Figure 1	**4**	4	AN
vi)	Compare Rectifier diode with Zener diode.	**4**	3	AP

Q.3	**Solve any two questions out of three**	**16**		
i)	Analyze effect of Miller's capacitance on frequency response of CS amplifier ?	**8**	4	AN
ii)	The circuit in Figure is to be used as a simple audio amplifier. Design the circuit such that the lower corner frequency is $f_L = 50$ Hz.  Figure 2	**8**	5	AP
iii)	Determine the corner frequency and maximum gain asymptote of a MOSFET amplifier. For the circuit in Figure the parameters are: $R_S = 3.2$ k , $R_D = 10$ k , $R_L = 20$ k , and $C_L = 10$ pF. The transistor parameters are: $V_{TP} = -2$ V, $K_P = 0.25$ mA/V^2, and $\lambda = 0$. $I_{DQ} = 0.5$ mA, $V_{SGQ} = 3.41$ V, and $V_{SDQ} = 3.41$ V.  Figure 3	**8**	4	AN

Q.4	**Solve any two questions out of three.**	**16**		
i)	Design the dc bias of a MOSFET circuit to meet a set of specifications. The circuit configuration to be designed is shown in Figure. The quiescent Q-point values are to be I_{DQ} =0.25mA, V_{DSQ}= 4V. The voltage across R_S should be V_{RS} ~= 1 V. The current in the bias resistors should be approximately 20 μA. A transistor with parameters of k_n'= 80 μA/ V^2, W/L = 4, and V_{TN} = 1.2 V is available.  Figure 4	**8**	5	AP
ii)	Explain the terms diffusion current density. Calculate diffusion current density for given semiconductor. Consider silicon at T=300K. Assume the electron concentration varies linearly from $n=10^{12}cm^{-3}$ to $n=10^{16}cm^{-3}$ over the distance from x=0 to x=3μm. Assume $D_n=35cm^2/s$.	**8**	1	U
iii)	Determine the small-signal voltage gain of a common-source circuit containing a source resistor. Consider the circuit in Figure. The transistor parameters are V_{TN} = 0.8 V, K_n = 1mA /V^2 and λ = 0.	**8**	4	AN

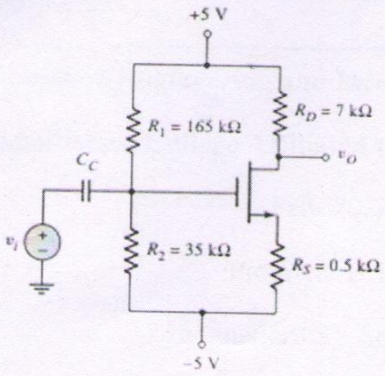

+5 V
$R_1 = 165\ \text{k}\Omega$
$R_D = 7\ \text{k}\Omega$
C_C
v_O
v_i
$R_2 = 35\ \text{k}\Omega$
$R_S = 0.5\ \text{k}\Omega$
−5 V

Figure 5