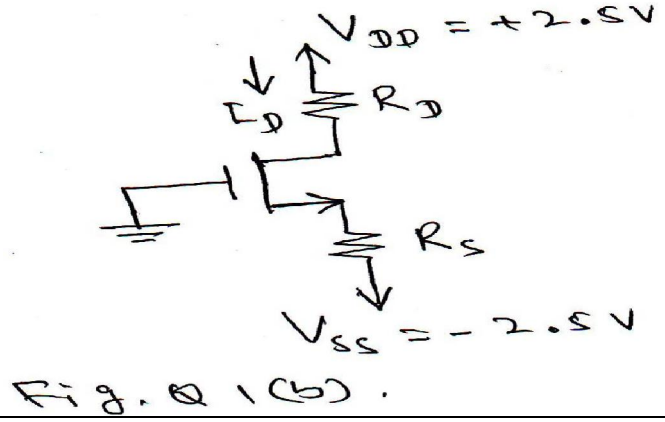
15EC655

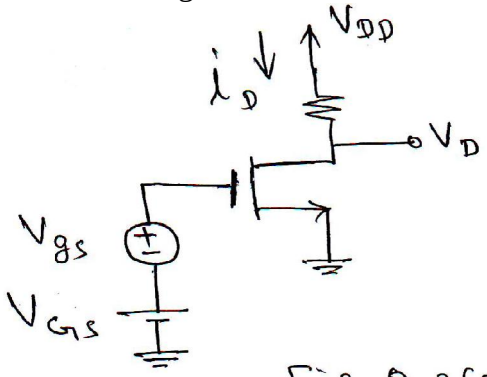
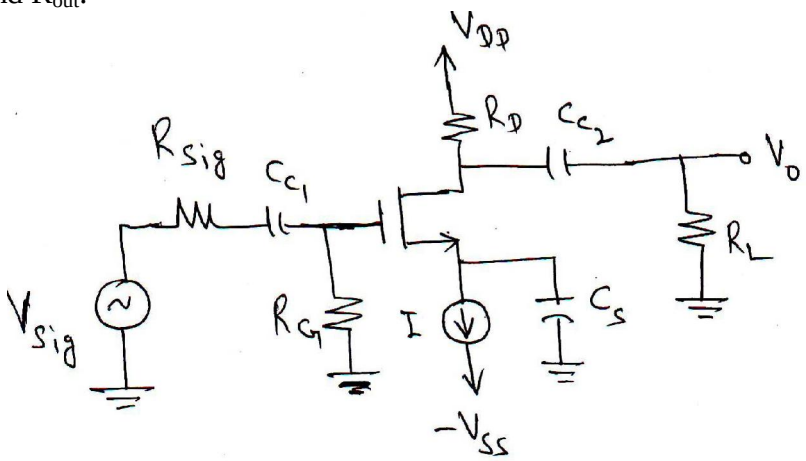
Visvesvaraya Technological University, Belagavi
MODEL QUESTION PAPER – Set II
6th Semester, B.E (CBCS) EC

Course: 15EC655 - Microelectronics

Time: 3 Hours **Max. Marks: 80**

Note: (i) Answer Five full questions selecting any one full question from each Module.
(ii) Question on a topic of a Module may appear in either its 1st or/and 2nd question.

		MODULE 1	
1	a.	Derive the expression of drain current of a MOS device for triode and saturation region.	6 Marks
	b.	For the circuit shown in Fig. 1(b) has I_D = 0.4mA and V_D = 0.5V. The NMOS transistor has V_t = 0.7V, μnC_{OX} = 100μA/V^2, L = 1μm and W = 32μm. Find the values of Rs and R_D. Assume λ = 0.  Fig. Q 1(b).	6 Marks
	c.	Mention the advantages of MOSFETs.	4 Marks
		OR	
2	a.	Explain the operation of enhancement type NMOS transistor in detail.	8 Marks
	b.	Discus the role of substrate in the MOS with relevant equations. NMOS transistor has V_{to} = 0.8V, $2\phi_f$ = 0.7V and γ = 0.4V$^{1/2}$, find Vt when V_{SB} = 3V.	8 Marks
		MODULE - 2	
3	a.	Draw the T – equivalent circuit model for the MOSFET and explain.	6 Marks
	b.	Explain the biasing of the MOSFET using constant current source.	6 Marks

	c.	Derive the expression of $A_V = -g_m R_D$ for the circuit shown in Fig. 3(c).  Fig. Q 3(c)	4 Marks
		OR	
4	a.	For the circuit shown in Fig. 4(a), obtain the expressions of R_{in}, A_V, A_{VO}, G_V and R_{out}.  Fig. Q 4(a)	8 Marks
	b.	Explain the role of various internal capacitances in the MOSFET.	8 Marks
		MODULE - 3	
5	a.	For an NMOS transistor with W/L = 10 fabricated in the 0.18µm process, find the values of V_{OV} and V_{GS} required to operate the device at I_D = 100µA. Ignore channel length modulation. Assume $\mu_n C_{OX} = 387\mu A/V^2$.	6 Marks
	b.	Explain the operation of a basic MOSFET current mirror.	5 Marks
	c.	State and prove the Miller's Theorem.	5 Marks
		OR	
6	a.	Draw and explain the circuit for generating the number of constant currents of various magnitude of a current steering.	8 Marks
	b.	Derive the expression for determining the 3-dB frequency (ω_H) of an amplifier.	8 Marks
		MODULE - 4	
7	a.	Draw the circuit diagram of a CMOS Common Source amplifier and explain its operation with the help of I-V characteristics and transfer	8 Marks

		characteristics.	
	b.	Explain what is Cascode amplifier and the basic idea behind the Cascode amplifier.	4 Marks
	c.	Explain the operation of a Double Cascoding.	4 Marks
OR			
8	a.	Draw the high frequency equivalent circuit model of the common source amplifier and explain the analysis using open circuit time constants.	8 Marks
	b.	Explain the effect of source resistance on transconductance and voltage gain of a CS- amplifier.	8 Marks
MODULE - 5			
9	a.	Explain the operation of MOS differential pair with a differential input voltage.	8 Marks
	b.	Obtain the expression of CMRR of an active loaded MOS differential amplifier.	8 Marks
OR			
10	a.	Draw the diagram of a two stage CMOS op-amp circuit and explain its operation.	8 Marks
	b.	Draw the frequency response of a differential amplifier due to variation of common - mode gain, differential gain and CMRR with frequency and analyse it.	8 Marks

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