Total No. of Questions – [08] Total No. of Printed Pages: 04

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Paper code - (U 219 - 134 (BE - F&FS

DECEMBER 2019/ENDSEM - Backlog Exam

S. Y. B. TECH. (E&TC) (SEMESTER - I)

COURSE NAME: Semiconductor Devices & Circuits

COURSE CODE: ETUA21174

(PATTERN 2017)

Time: [**2Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) Draw voltage divider biasing circuit and Derive the expression for stability factor for voltage divider biasing circuit. [6 marks]

OR

b) Calculate the Q point values of I_B, Ic and V_{CE} for the voltage divider bias circuit, if V_{CC}=12 V, R_1=8KΩ, R_2=4 KΩ, R_C=1KΩ and R_E=1 KΩ. Assume silicon transistor with β= 50. [6 marks]

Q. 2)a) Draw the construction of n-channel JFET and explain its working in detail along with its characteristics. [6 marks]

OR

b) N-channel JFET common source amplifier with bypass capacitor has R_G=1MΩ, R_D=5KΩ, R_S=1KΩ, g_m=2mA/V, r_d=10KΩ, Determine A_v, R_i and R_o. [6 marks]

Q. 3) a) Draw and explain the output characteristic and transfer characteristic of N channel E-MOSFET. [6 marks]

OR

b) Explain following non-ideal effects for MOSFET.
i) Body effect
ii) Break down effect [6 marks]

Q. 4) a) For CS amplifier with voltage divider biasing circuit using n-channel MOSFET has V_{DD}= 10V, R_1=70 KΩ, R_2= 27 KΩ, R_D= 5KΩ. Calculate the values of gm, and r_o. Assume following data for MOSFET: V_T= 1.2V, K_n=0.48mA/v² and λ=0.012A/V. [4 marks]

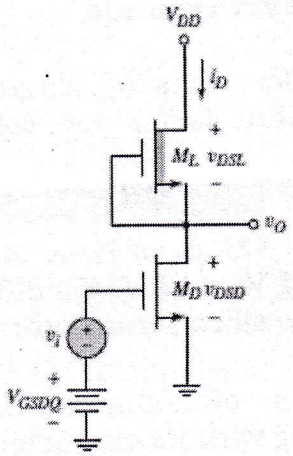
OR

b) For CS amplifier using MOSFET determine g_m, I_D and r_o if V_T= 1 V, K_n= 0.8 mA/V^2, λ= 0.01/V, V_{GSQ}= 3V. [4 marks]

Q. 5) a) Explain how n-channel MOSFET and p-channel MOSFET can be used as current sink and source respectively with the help of output I-V characteristics of both? [6 marks]

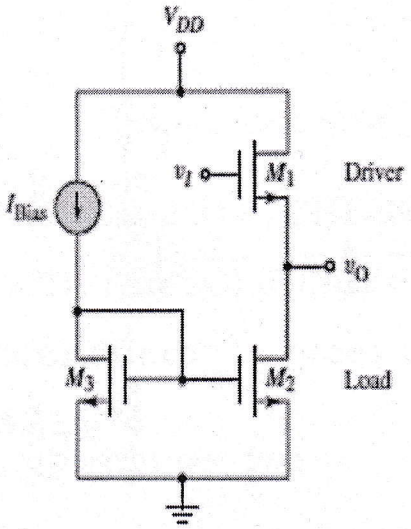
b) Draw MOSFET as a practical switch model. Explain the significance of each component. [4 marks]

c) Determine the small-signal voltage gain of the NMOS amplifier with depletion load. For the circuit shown in figure, assume transistor parameters of V_{TND}= +0.4 V, V_{TNL}= −0.8 V, K_{nD}= 2 mA/V^2, K_{nL}= 0.4 mA/V^2, λ_D= 0.01 V^{-1}, and λ_L= 0.02 V^{-1} Assume the transistors are biased at I_{DQ}= 0.2 mA. [4 marks]



OR

Q. 6)a) The transconductance g_{m1} of the transistor M_1in the circuit of figure is to be changed by changing the bias current such that the output resistance of the circuit is R_o= 2 kΩ. Assume the bias voltage is V_{DD}= 3.3 V. Assume that all transistors are matched with parameters V_{TN}= 0.4 V, K_n= 0.20 mA/V^2, and λ = 0.01 V^{-1}. The drain current in M_1 is I_{D1} = I_{Bias} = 0.2 mA. (a) What are the required value of $g_{m1}$and new value of I_{Bias}? (b) Using the results of part (a), what is the small-signal voltage gain? [6 marks]



b) Sketch CMOS common-gate amplifier circuit and its small-signal equivalent circuit. Write expression for small-signal voltage gain and output resistance. [4 marks]

c) Sketch NMOS source follower amplifier circuit and its small-signal equivalent circuit. Write expression for small-signal voltage gain and output resistance [4 marks]

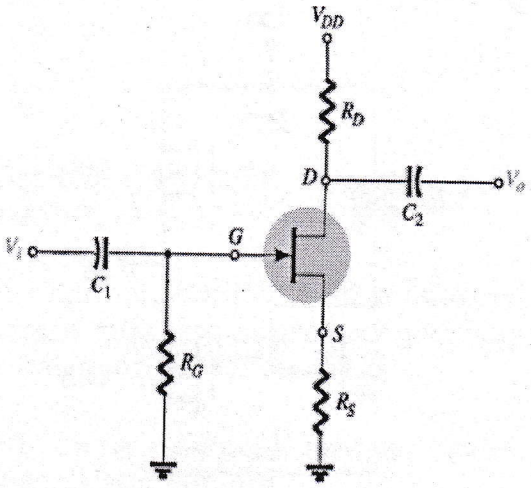
Q. 7) a) Draw block schematic of following feedback topologies:
i) Voltage series feedback topology
ii) Voltage shunt feedback topology
iii) Current series feedback topology [6 marks]

b) A Colpitt Oscillator circuit having two capacitors of 24nF and 240nF respectively are connected in parallel with an inductor of 10mH. Determine the frequency of oscillations of the circuit. [4 marks]

c) Explain Hartley oscillator with neat circuit diagram. Also write it's cut off frequency expression. [4 marks]

OR

Q. 8) a) For a given current series feedback amplifier, determine G_{mf}, A_{vf}, R_{if}, R'_{of} if R_s=1KΩ, R_D= 3.9KΩ, R_G=1MΩ, g_m=2mA/V and r_o=25KΩ. [6 marks]



b) Draw neat circuit diagram of Colpitt oscillator and explain it's working in detail. [4 marks]

c) Draw circuit diagram and AC equivalent of voltage series feedback amplifier and write it's final expression for ac parameters. [4 marks]