VIT® Vellore Institute of Technology

Reg. No. : 21BEC1851

Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	**B.Tech**	Semester	**Winter Semester 2022-23**
Course Title	**ANALOG CIRCUITS**	Course Code	**BECE206L**
Faculty Name	**Prof. Sangeetha R G**	Slot	**F1+TF1**
		Class Nbr	**CH2022235002479**
Time	**3 Hours**	Max. Marks	**100**

Section-A (4 X 10 Marks)
Answer All questions

01. Draw the high frequency equivalent circuit of a common-emitter amplifier and derive its short circuit current gain and beta cut-off frequency. **[10]**

02. A common-source equivalent circuit is shown in Figure 1. The transistor transconductance is 3 mA/V. Calculate the equivalent Miller capacitance. Determine the upper 3 dB frequency for the small-signal voltage gain. **[10]**

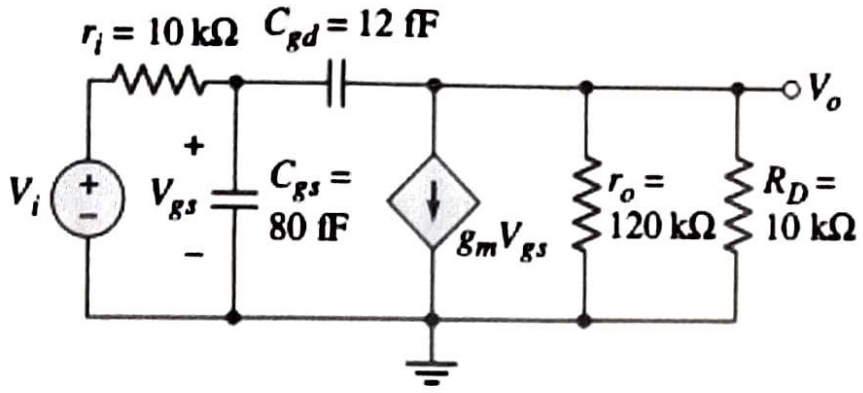

Figure 1

03. a. Explain the working of Class-B MOSFET power amplifier. What are the problems faced in power amplifiers and provide suitable techniques to counteract the same? **[10]**

b.Calculate the actual efficiency of Class-A output stage shown in Figure 2. The circuit parameters are V_{DD} = 10 V and R_D = 5 kΩ. Assume the quiescent voltage is 5.16 V to minimize nonlinear distortion and the peak voltage of the sinusoidal signal is 3.84 V.

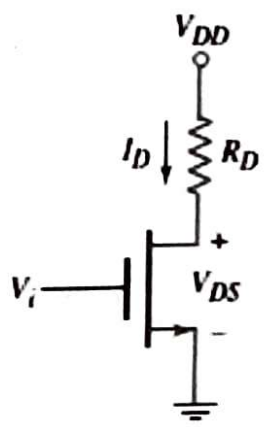

Figure 2

04. Explain the function of a 3 bit R-2R ladder digital to analog converter with the necessary diagram and derive the expression for the output stage **[10]**

Section-B (4 X 15 Marks)
Answer All questions

05. a.Draw a two-transistor basic current mirror circuit using MOSFET and derive an expression to determine the ratio of output current to reference current. How does the output resistance influence the transistor circuit? (7 Marks) **[15]**

b.Determine a MOSFET differential-mode voltage gain and common mode gain of a differential amplifier. Consider a MOSFET diff-amp with the configuration in Figure 3. Assume the same transistor parameters are $K_n = 1\ mA/V^2$, $I_Q = 1\ mA$, assume $\lambda = 0.01\ V^{-1}$ for *M*4 and for all other transistors, $\lambda = 0$ (8 Marks)

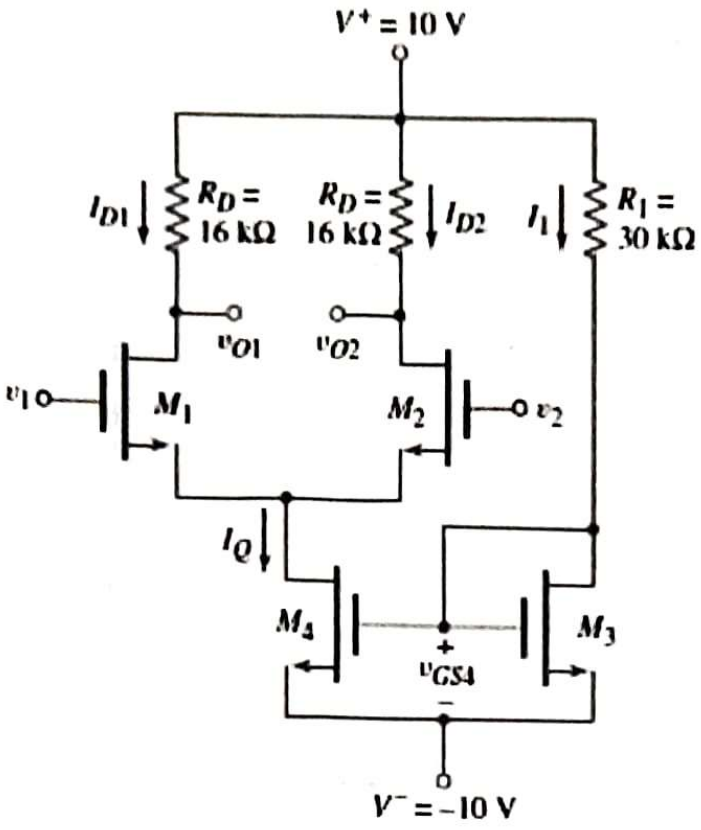

Figure 3

06. a.For the non-inverting amplifier shown below in Figure 4, calculate (i). A_{CL} (ii) V_o (iii) I_L (iv) I_o (8 Marks) **[15]**

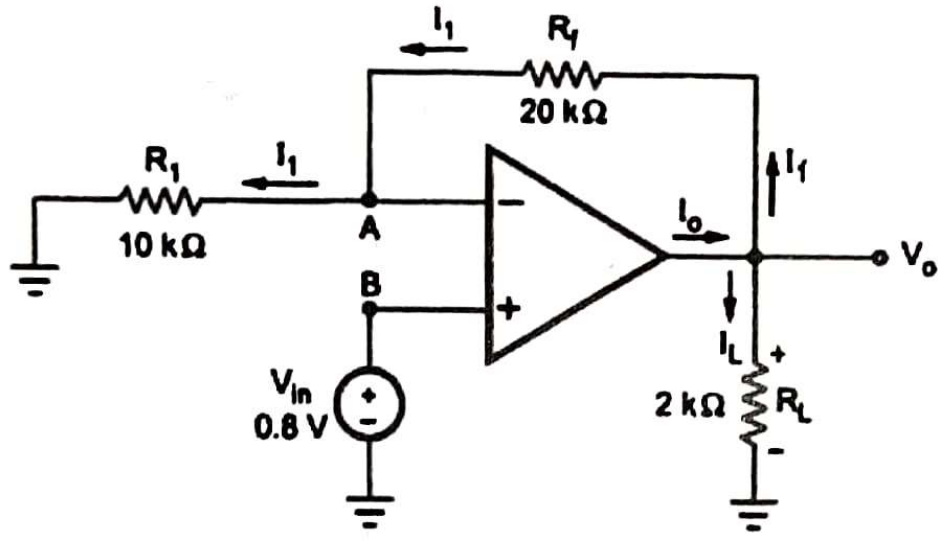

Figure 4

b. Determine the range of the gain if the potentiometer is varied over its entire range for the following instrumentation amplifier shown in Figure 5. (7Marks)

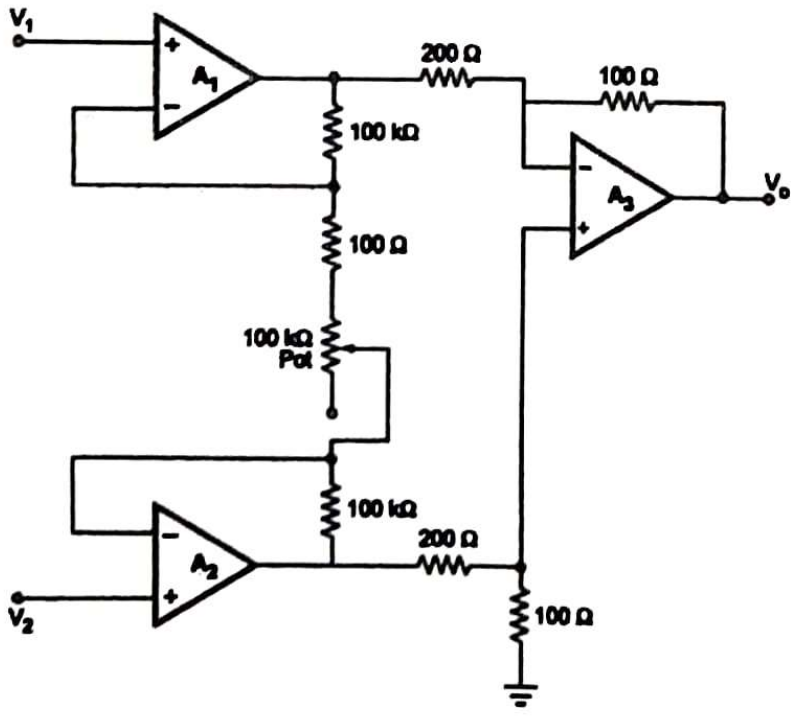

Figure 5

07. a.Consider a three stage RC phase shift oscillator and derive an expression to determine its frequency of oscillation and the condition required for oscillation (10 Marks) **[15]**

b.Derive the first order high pass filter expression at a cut-off frequency of 1 KHz and gain of 2. Tabulate and Plot the frequency response of the filter. (5 Marks)

08. a. Determine the circuit in which one of the states is stable, but the other state is transient using 555 timer and briefly discuss its working principle. Derive the expression of pulse width for the above circuit (10 Marks) **[15]**

b. Elaborate the working principle of a free running non-sinusoidal Oscillator (5 marks)

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