



**P.E.S. College of Engineering, Mandya - 571 401**

*(An Autonomous Institution affiliated to VTU, Belagavi)*

**Second Semester, M. Tech - VLSI Design and Embedded System (MECE)**

**Semester End Examination; May/ June - 2019**

**Design of Analog and Mixed Mode VLSI Circuits**

Time: 3 hrs

Max. Marks: 100

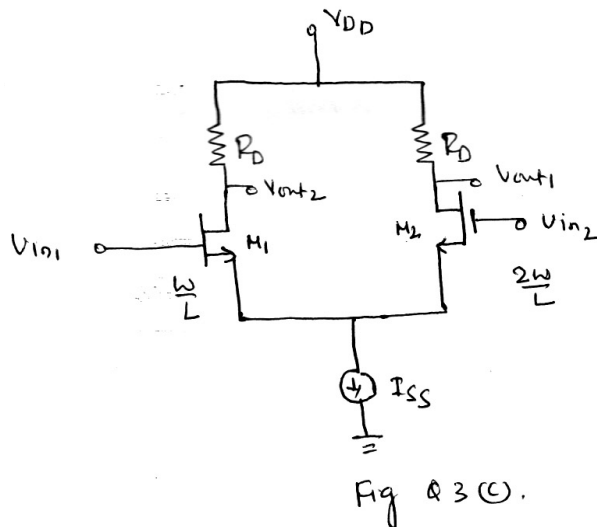
Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

**UNIT - I**

- 1 a. Discuss the following second order effects in MOS device : 8
  - i) Body effect ii) Channel length modulation
- b. For a common source stage using diode connected load, obtain the expression for voltage gain using small signal model. 6
- c. For a source follows obtain the expression for  $A_v$ . 6
- 2 a. For a common gate stage, obtain the expression for voltage gain taking channel length modulation into consideration. 8
  - b. Derive the expression for output impedance of cascade stage. 8
  - c. Compare common source and common gate amplifier with respect to voltage gain, input impedance and output impedance. 4

**UNIT - II**

- 3 a. For a differential amplifier with current source load, obtain the expression for voltage gain. Suggest a method to increase the voltage gain. 8
- b. Explain the operation of Gilbert cell. 6
- c. For the circuit of Fig. 3(c), calculate the small signal gain given that, width of  $M_1$  is one half of that of  $M_2$  and bias values of  $V_{in1}$  and  $V_{in2}$  are equal.



- 4 a. What is a current mirror? What are its applications? Explain the operations of cascade current mirror. 10

- b. For a differential amplifier with current mirror, obtain the expression for common mode gain  $A_{CM}$ . 10

### UNIT - III

- 5 a. Discuss the implementation of two stage Op-Amp. Explain how gain boosting is done? 10
- b. What is the need for common mode feedback? Discuss how common mode feedback is done using resistive sensing and source followers? 10
- 6 a. What is a band gap reference? Discuss the generation of temperature independent voltage. 8
- b. Discuss the generation of PTAT. 6
- c. What is the need for constant  $G_m$  biasing? Explain how constant  $G_m$  biasing is done using switched capacitor resistor? 6

### UNIT - IV

- 7 a. Discuss the response of sampling circuit to differential input levels with initial conditions. 6
- b. Discuss the following effects in switched capacitor circuits : 8
- i) Channel charge injection
- ii) Clock feed through
- c. Explain the operation of unity gain sample in sampling mode and amplification mode. 6
- 8 a. For Colpitts oscillator derive the expression for : 10
- i) Condition for sustained oscillators
- ii) Frequency of oscillators
- b. What is  $V_{CO}$ ? Explain the important performance parameters of  $V_{CO}$ . 10

### UNIT - V

- 9 a. Develop the linear model of type-I PLL and obtain its step response. 10
- b. A cellular telephone incorporates a 900 MHz PLL to generate the carry frequencies. If  $W_{LPF} = 40 \pi \text{kHz}$  and the output frequency is to be changed from 901 MHz to 901.2 MHz, how long does the PLL output frequency take to settle within 100 Hz of its final value? 4
- c. Discuss how the addition of frequency detection increases the acquisition range? 6
- 10 a. What is delay locked loop? Explain its construction. 10
- b. Explain how PLL can be used to eliminate skew? 10

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