T.E. (ExTC) (Sem -V) (CB)   Date-27/11/19

(3 Hours)   [Total Marks : 80]

Please check whether you have got the right question paper.

N.B.:
1) Question No.1 is Compulsory.
2) Solve any three questions from reaming five questions.
3) Figures to the right indicate full marks.
4) Assume suitable data if required and mention the same in answer sheet.

1. Attempt **any four**   (20)
   i) Derive equation for gain of common gate amplifier
   ii) Explain how MOSFET is used as controlled resistor
   iii) Draw a mask layout of NMOS transistor
   iv) Draw simple two transistor current mirror and derive expression for output current I_O and minimum output voltage required i.e V_{ON}.
   v) Explain how inductors are fabricated in Integrated circuits.

2. a) What are different types of MOSFET scaling. Explain impact of scaling on MOSFET performance parameters such as I_{DS}, Area, Power and delay with the help of appropriate equations.   (10)

   b) Explain how cascode current mirror improves performance of simple current mirror. Also derive expression for output resistance and minimum output voltage required i,e V_{omin} for proper operation of cascode current mirror.   (10)

3. a) Explain DC transfer characteristics of MOS differential Amplifier by deriving appropriate equations.   (10)

   b) Explain with proper diagram class C power Amplifier.   (10)

4. a) Explain NMOS fabrication process with suitable diagrams.   (10)

   b) Draw and explain the working of common source amplifier with NMOS diode connected load. Derive expression for voltage gain and output voltage swing. (10)

5. a) Design common source resistive load amplifier to meet following specification. (10)
   Av $\geq$ 10, output swing = 3V, Pdmax $\leq$ 5mW.
   Use V_{DD} = 5V, $\mu nCox$ = 150$\mu A/V^2$, λ = 0.01 V^{-1}, V_{TN} = 1V.

b) For the circuit shown below $V^+ = 10V$, $V^- = 0V$. Transistors parameters are V_{TN} **(10)** $= 2V$, $\mu nCox = 40\mu A/V^2$ and $\lambda = 0$. Design the circuit such that $I_{REF} = 0.5$ mA, $I_0 = 0.2mA$ and M2 remains biased in saturation region for $V_{DS2} \geq 1V$.
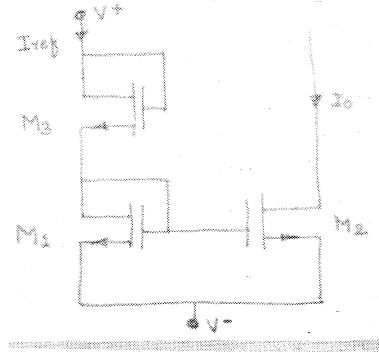
6. Write short notes on **any four** **(20)**
   i) Bias Independent current source
   ii) Class B power amplifier using MOSFET
   iii) Fabrication of transforms
   iv) Fabrication of variable capacitor
   v) Short channel effects