

Total No. of Questions : 8]

SEAT No. :

**P4306**

**[4860]-1256**

[Total No. of Pages : 2

**M.E. (E & TC) (VLSI & Embedded Systems)**

**ANALOG CMOS DESIGN**

**(2013 Credit Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of electronic pocket calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1)** a) Explain the effect of channel length modulation and body effect on MOSFET & show how these are accounted in basic small signal model. **[5]**

b) With the help of suitable schematic and necessary expressions, explain MOSFET as switch, diode and active resistor. **[5]**

**Q2)** a) For subthreshold MOS model, explain weak inversion using its transconductance characteristics and equations involved. Also explain significance of weak inversion. **[5]**

b) Explain in detail, short channel effects: threshold voltage variation, velocity saturation and output impedance on overdrive voltage. **[5]**

**Q3)** a) Explain the performance parameters of CMOS operational amplifier. **[5]**

b) Design cascode current mirror for  $i_{OUT} = 100 \mu A$ . Assume suitable data. **[5]**

**Q4)** a) Explain significance of micropower Op amp with examples of two stage miller Op and push-pull output Op amp. **[5]**

b) Design CS-CG cascode amplifier for  $A_v = 60$  dB and bandwidth 10 MHz. **[5]**

**P.T.O.**

- Q5) a)** Explain static characteristics of Digital-to-Analog converter used for signal processing applications. Also explain offset error and gain error with respect to static characteristics. **[5]**
- b)** Draw circuit diagram of switched capacitor inverting amplifier and derive expression for its transfer function. **[5]**
- Q6) a)** Write short notes on: **[6]**
- i) Switched capacitor.
  - ii) Bandwidth estimation.
  - iii) Zeros as bandwidth enhancer.
- b)** If the sampled analog input applied to an 8-bit SAR converter is  $0.7 V_{\text{ref}}$ . Find output digital word. **[4]**
- Q7) a)** Explain design considerations for RF chip design. **[4]**
- b)** Draw schematic of any one type of CMOS mixer and explain its design with analysis. **[6]**
- Q8) a)** Draw differential LNA, and explain how it overcomes drawbacks of single ended LNA. **[5]**
- b)** In Low Noise Amplifier (LNA) design, explain how noise and power tradeoff is achieved with respect to different LNA topologies. **[5]**

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