

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2117**

Roll No.

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**B. Tech.**

**(SEMESTER-V) THEORY EXAMINATION, 2012-13**

**INTEGRATED CIRCUITS**

*Time : 3 Hours ]*

*[ Total Marks : 100*

**Section – A**

1. Attempt all question parts : 10 × 2 = 20
- For Widlar Current source assume the  $I_{ref} = 1 \text{ mA}$  and  $R_2 = 5 \text{ K}\Omega$ , neglect base current and find  $I_{C2}$ .
  - List the advantages of Widlar current source.
  - Find the voltage gain of the CE amplifier with active load circuit when both devices are active.
  - Define the term “Sensitivity”.
  - Give reason – “The voltage gain of the operational amplifier decreases at high frequencies”.
  - Write some applications of analog multiplier.
  - What are the parameters determine the performance of VCO ?
  - Calculate the time period of Astable Multivibrator having  $R_1 = R_2 = 2 \text{ K}\Omega$  ,  $R = 4 \text{ K}\Omega$  and  $C = 0.01 \text{ uF}$ .
  - Why CMOS NAND is preferred over CMOS NOR ?
  - List the disadvantages of Sallen – Key Unity Gain filter.

**Section-B**

2. Attempt any **three** question parts : 10 × 3 = 30
- Derive a voltage gain expression for Dual Input Balanced Output Differential Amplifier.
  - With neat circuit diagram explain the generation of square wave form using Op-Amp astable multivibrator and calculate its total time period.

- (c) Design a Wein-Bridge Oscillator circuit and derive expression for sustained oscillations.
- (d) (i) Implement the following expression using AOI gate logic.
- $$F = \overline{A(B + CD)}$$
- (ii) Explain the transistor sizing procedure for a four input NOR gate.
- (e) Design a filter using the Sallen – Key unity gain low pass active filter to meet the following specifications: Assume  $C = 0.027 \mu\text{f}$ .
- (i) Rolloff Rate : 40 dB/decade
- (ii) Critical Frequency : 4 kHz
- (iii) Pass band as flat as possible
- (iv) Gain of 10 at DC

### Section – C

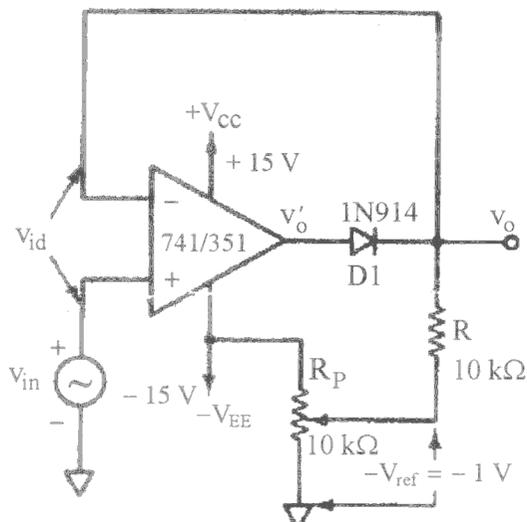
Attempt **all** questions :

$10 \times 5 = 50$

3. Attempt any **two** parts :

$5 \times 2 = 10$

(a) Draw the output of the following circuit and explain its working.

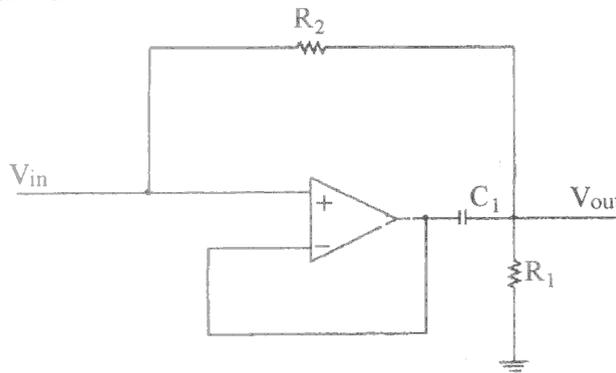


- (b) Draw a Cascode MOS current mirror and calculate its output impedance.
- (c) How Current Mirror can be used as an ACTIVE LOAD ? Draw the BJT differential amplifier circuit using ACTIVE LOAD.

4. Attempt any **two** parts : **5 × 2 = 10**
- What is the effect of  $V_0$  on  $I_0$  in MOS Current Mirrors ?
  - Draw and explain sample and hold Op-Amp circuit.
  - Name the circuit that is used to detect the peak value of the non-sinusoidal waveforms. Explain the operation with neat circuit diagram.

5. Attempt any **two** parts : **5 × 2 = 10**
- Two CMOS inverters operating from a 5-V supply have  $V_{IH}$  and  $V_{IL}$  of 2.42 V and 2.00 V and corresponding outputs of 0.4 and 4.6, respectively, and are connected as a latch. Approximating the corresponding transfer characteristic of each gate by a straight line between threshold points, sketch the latch open-loop transfer characteristic. What are the coordinates of point B (unstable point) ? What is the loop gain at B ?
  - Draw and explain monostable multivibrator using 555 timer and calculate its time period.
  - Design a precision peak rectifier and explain its working operation.
    - Using a 10 nF capacitor, find the value of R that yields an output pulse of 100  $\mu$ s in the monostable circuit.

6. Attempt any **one** part : **10 × 1 = 10**
- Draw the KHN Biquad filter and derive transfer function of the BPF and LPF from that.
  - Find the  $V_{in} / I_{in}$  for the following circuit :



7. Attempt any **two** parts : **5 × 2 = 10**
- Draw and explain the PLL block diagram.
  - Design a parallel-flash ADC and explain its working.
  - Draw and explain a GILBERT analog multiplier.