

(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 $C = 0.01 \text{ }\mu\text{F}$.
 - 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

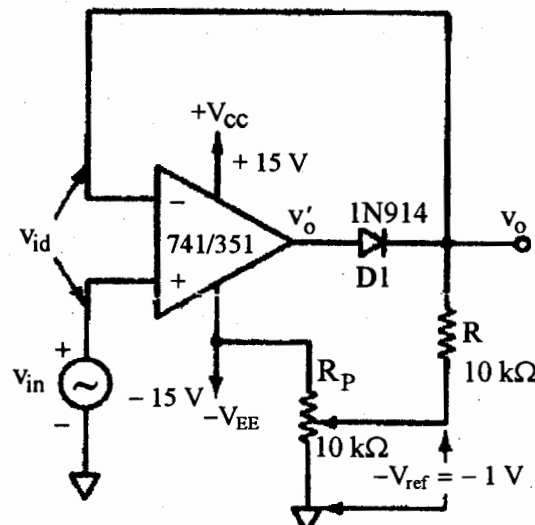
Attempt **all** questions :

$10 \times 5 = 50$

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

- (a) What is the effect of V_0 on I_0 in MOS Current Mirrors ?
- (b) Draw and explain sample and hold Op-Amp circuit.
- (c) 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 :

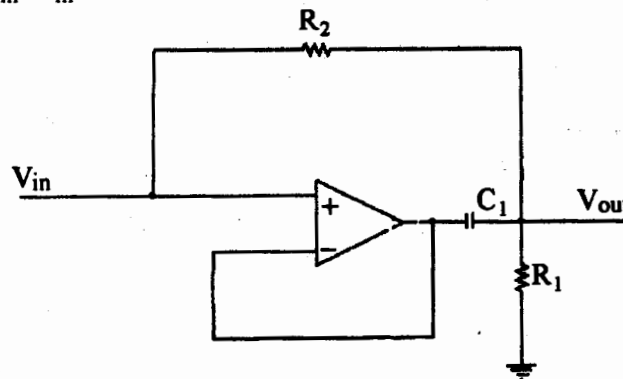
5 × 2 = 10

- (a) 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 ?
- (b) Draw and explain monostable multivibrator using 555 timer and calculate its time period.
- (c) (i) Design a precision peak rectifier and explain its working operation.
(ii) Using a 10 nF capacitor, find the value of R that yields an output pulse of 100 μ s in the monostable circuit.

6. Attempt any one part :

10 × 1 = 10

- (a) Draw the KHN Biquad filter and derive transfer function of the BPF and LPF from that.
- (b) Find the V_{in} / I_{in} for the following circuit :



7. Attempt any two parts :

5 × 2 = 10

- (a) Draw and explain the PLL block diagram.
- (b) Design a parallel-flash ADC and explain its working.
- (c) Draw and explain a GILBERT analog multiplier.