

II B.Tech. II Semester Regular Examinations, April/May -2005
LINEAR AND DIGITAL IC APPLICATIONS
(Common to Electrical & Electronic Engineering, Electronics & Computer
Engineering and Instrumentation & Control Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Explain in detail all the dc and ac characteristics of an ideal OP-AMP with relevant expressions
2. (a) Draw the circuit and explain the working of
 - i. voltage to current converter,
 - ii. current to voltage converter.(b) Draw a circuit using Op-Amp, which can work as adder (inverting and non-inverting) and explain how it works.
3. (a) Briefly describe three uses of an analog multiplier.
(b) What do you mean by sampling? Explain the basic circuit for sample and hold circuit.
4. (a) Draw the circuit of Schmitt trigger using 555 timer and explain its operation.
(b) How is an Astable multivibrator using 555 timer connected in to a pulse position modulator?
5. (a) Give the functional block diagram of NE 565 PLL (DIP) and for the given component values. $C_1 = 390PF$, $C_2 = 680PF$ and $R_1 = 10k$, $V_{cc} = \pm 6V$
Find
 - i. The free running frequency
 - ii. The lock range and capture rangeWhere C_1 is the capacitor connected between pin number 9 and $-V_{CC}$, C_2 is the capacitor connected between $+V_{CC}$ and output pin 7, and R_1 is connected between pin number 8 and $+V_{CC}$
(b) Give the functional block diagram of VCO NE566 and explain its working and necessary expression for free running or center frequency.
6. (a) Explain the design procedure (with suitable circuit diagram of a fourth order Butterworth low-pass filter).
(b) A certain narrow band-pass filter has been designed to meet the following specifications: $f_C = 2kHz$, $Q = 20$, and $A_p = 10$. What modifications are necessary in the filter circuit to change the center frequency ' f_c ' to $1kHz$, keeping the gain and band-width constant?

7. (a) Compare different logic families and mention their advantages and disadvantages?
(b) Which is the fastest non-saturated logic gate ? Draw the circuit and explain its functions.
8. (a) Why successive approximation A/D converter faster than dual-slope A/D converter? Explain.
(b) Draw the complete schematic circuit of successive approximations A/D converter and explain operations of this system.

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1. (a) What is an OP-AMP? Why it is called so?
 (b) Explain the parameters that should be considered for ac and dc applications of an OP-AMP
 (c) Draw and explain the three open loop OP-AMP configurations with neat circuit diagram
2. (a) We wish to use the circuit of a inverting summing amplifier to provide the class average on a quiz. The class size is 25 and all grades are integers between 1 and 10.
 (b) The maximum output voltage is 10 V, and the minimum resistance that can be used is $1K\Omega$. The minimum value of input voltage that can be used is $250\mu V$.
 - i. Design the circuit
 - ii. Check your design with the following grade distribution.

Number of students	0	1	0	2	1	4	7	4	3	3
Quiz grade	1	2	3	4	5	6	7	8	9	10

3. (a) Describe the principle of operation of a precision half wave rectifier with wave forms.
 (b) Draw a sample and hold circuit and explain its operation with necessary input and output waveforms and indicate its uses.
4. Discuss, with relevant circuits and waveforms, the working of Monostable multivibrator using 555 timer.
5. (a) Give the block diagram of 565 PLL (DIP) and explain about each block and for the given component values find the free running frequency f_o , lock-range and capture range $C_1=470PF$; $C_2=1000PF$, $R_1=10k$ and $V_{CC} = \pm 6V$
 C_1 connected between pin 9 and $-V_{CC}$
 C_2 connected between pin 7 and $+V_{CC}$.
 (b) Give any two applications of PLL and explain about each one on detail.
6. (a) What are the advantages of active filters over passive ones?

- (b) Design a second order low pass Butterworth filter for a cut off frequency of $2kHz$. Assume necessary data.
- (c) What is an all pass filter? Draw the circuit of the filters.
7. For the circuit shown below (figure 1)
- (a) Explain the operations and the circuit with the help of Truth-Table.
- (b) If h_{FE} of Q_1 is 30, find h_{FEmin} of Q_2 .
- (c) If h_{FE} of Q_2 is 30, what is Fan-Out?
- (d) Find Noise Margins.

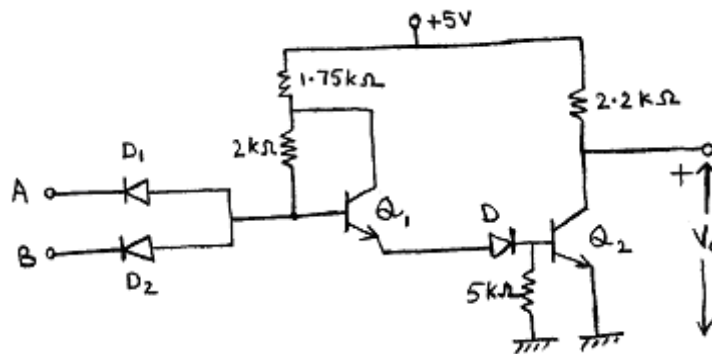


Figure 1:

8. (a) List out various types of D/A converter and A/D converters and compare their merits and demerits.
- (b) Give the schematic circuit of successive approximations A/D converter and explain its operations.

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1. (a) Why is it necessary to use an external offset voltage compensating network with practical OP-AMP circuits?
(b) Compare and contrast an ideal OP-AMP and practical OP-AMP.
(c) Explain the precautions that can be taken to minimize the effect of noise on an OP-AMP circuit.
(d) Calculate the effect of variation in power supply voltages on the output offset voltage for an inverting amplifier circuit.
2. (a) Explain the operation of Zero crossing detector.
(b) Briefly mention the disadvantages of using Zero crossing detector and how it is overcome in Schmitt Trigger?
3. (a) Describe the principle of operation of a precision half wave rectifier with wave forms.
(b) Draw a sample and hold circuit and explain its operation with necessary input and output waveforms and indicate its uses.
4. (a) What are the two basic modes in which the 555 timer operates? Briefly explain the differences between the two operating modes of the 555 timer.
(b) Design a ramp generator using 555 timer having an output frequency of approximately $5KHz$.
5. (a) Explain the terms Lock range, Capture range and Pull-in time a PLL. How are Lock Range and Capture range determined?
(b) Design a PLL circuit using IC 565 to get
 - i. Free-running frequency = $4.5 KHz$
 - ii. Lock range of $2 KHz$ and
 - iii. Capture range = $100 Hz$.Assume a supply voltage of + or - 10V. Show the circuit diagram with all component values.
6. (a) Define Bessel, Butterworth and Chebyshev filters, and compare their frequency response.
(b) Sketch the circuit diagram of band elimination filter and design a wide band-reject having $f_H=200Hz$ and $f_L=1kHz$. Assume necessary data.

7.
 - (a) Draw the schematic circuits of CMOS NAND and CMOS NOR gates and explain their functions with the help of Truth-Table.
 - (b) What are the advantages and disadvantages of CMOS over TTL gate?
 - (c) Which is the fastest saturated logic gate? And Why ?
8.
 - (a) List out different types of A/D converters.
 - (b) Draw the schematic circuit diagram of dual-slope A/D converter and explain its operation. Derive expression for output voltage.
 - (c) Compare dual-slope A/D converter with successive approximation A/D converter.

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1. (a) Define the terms : SVRR, CMRR, input bias current, input offset voltage, Gain Bandwidth product
(b) What are the differences between the inverting and non inverting terminals? What do you mean by the term “virtual ground”?
2. (a) Explain how an Op-Amp can be used as summing amplifier? Draw the diagram of a four input summer and obtain the expression for the output.
(b) The circuit of a inverting summing amplifier is designed with $R_1 = R' = 1K\Omega$, and $R_2 = 2R_1$, $R_3 = 2R_2$, .. $R_n = 2R_{n-1}$. the input voltages $v_1, v_2, \dots v_n$ can be 0 or 10V.
 - i. For $n = 4$, what is the smallest output voltage if atleast one input is nonzero?
 - ii. For $n = 4$, what is the maximum output voltage?
3. (a) Describe the principle of operation of a precision half wave rectifier with wave forms.
(b) Draw a sample and hold circuit and explain its operation with necessary input and output waveforms and indicate its uses.
4. (a) Design a 555 Astable multivibrator to operate at 10 KHz with 40% duty cycle.
(b) Explain in which the 555 timer can be used as Astable multivibrator
5. (a) Explain the terms Lock range, Capture range and Pull-in time a PLL. How are Lock Range and Capture range determined?
(b) Design a PLL circuit using IC 565 to get
 - i. Free-running frequency = 4.5 KHz
 - ii. Lock range of 2 KHz and
 - iii. Capture range = 100 Hz.Assume a supply voltage of + or - 10V. Show the circuit diagram with all component values.
6. (a) What are the advantages of active filters over passive ones?
(b) Design a second order low pass Butterworth filter for a cut off frequency of 2kHz. Assume necessary data.
(c) What is an all pass filter? Draw the circuit of the filters.

7. (a) Realize the given expression $y = \overline{AB + CD}$ using N-Mos logic and verify it. What is the name of the given function and what is its advantage?
(b) Compare the relative merits of NMOS, CMOS, TTL and ECL logic families.
8. (a) Why successive approximation A/D converter faster than dual-slope A/D converter? Explain.
(b) Draw the complete schematic circuit of successive approximations A/D converter and explain operations of this system.

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