

II B.Tech I Semester Regular Examinations, November 2005
LINEAR AND DIGITAL IC APPLICATION
(Common to Computer Science & Engineering, Information Technology
and Computer Science & Systems Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Derive the expression for CMRR for the first stage differential amplifier [8]
(b) Explain about any two linear and nonlinear applications of OP-AMP [8]
2. (a) Classify the types of OP-AMP based multipliers. How a multiplier can be used to [8]
 - i. double the incoming frequency
 - ii. detect the phase angle of a signal
- (b) Design a subtractor in non inverting configuration [8]
3. (a) Draw the schematic diagram of Wien Bridge Oscillator and derive the expression for frequency of oscillation [10]
(b) What are the conditions to be satisfied by a circuit to produce oscillations? [6]
4. (a) Draw and explain the functional diagram of a 555 Timer [12]
(b) Explain the function of 'reset' pin. [4]
5. Define the terms Lock range and Capture range, A PLL has a free running frequency of 500 KHz , the bandwidth of the LPF = 10 KHz . Will the PLL lock in if $f_i = 60\text{ KHz}$? What is the frequency of the VCO output? [16]
6. (a) Define Bessel, Butterworth and Chebyshev filters, and compare their frequency response. [8]
(b) Sketch the circuit diagram of band elimination filter and design a wide band-reject having $f_H=200\text{ Hz}$ and $f_L=1\text{ kHz}$. Assume necessary data. [8]
7. (a) Compare different logic families and mention their advantages and disadvantages? [8]
(b) Which is the fastest non-saturated logic gate ? Draw the circuit and explain its functions. [8]
8. (a) Give the working principle of Analog-Multiplexer. Give block diagram of a 16 input analog multiplexer using CMOS gates and explain how it works. [8]
(b) Draw the circuit diagram of sample and hold circuit and explain its working. [8]

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1. (a) What are the three differential amplifier configurations? Compare and contrast these configurations. [7]
(b) what is a level translator circuit? Why is it used with the cascaded differential amplifier used in OP-AMPS? [5]
(c) Explain the term ‘Slew Rate’ and how it affects the frequency response of an an OP-AMP? [4]
2. (a) Design a unity gain summing amplifier to add three dc input voltages -0.5V, 0.1V and 0.75V in inverting configuration. If the saturation voltages of the OP-AMP are +18V, and -18V, find the possible maximum gain of the amplifier. [8]
(b) Design a subtractor circuit whose output is equal to the difference between the two inputs. Use a differential OP-AMP configuration [8]
3. (a) Derive the frequency of oscillation of a RC phase shift oscillator and explain the operation of the circuit. [12]
(b) Define supply voltage sensitivity. What is meant by poorly regulated power supply? [4]
4. (a) Explain the functions of each of pins in 555 timer. [8]
(b) List the important features of 555 timer. [8]
5. (a) Explain the terms Lock range, Capture range and Pull-in time a PLL. How are Lock Range and Capture range determined? [8]
(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. [8]
6. (a) What are the advantages of active filters over passive ones? [5]
(b) Design a second order low pass Butterworth filter for a cut off frequency of 2kHz. Assume necessary data. [6]
(c) What is an all pass filter? Draw the circuit of the filters. [5]

7. For the given circuit explain its operation with the help of Truth Table. Find h_{FEmin} , Fan-out if $h_{FE}=30$, and Noise-Margin for the given circuit shown below (figure 1). (Assume all the active devices are made of silicon). [16]

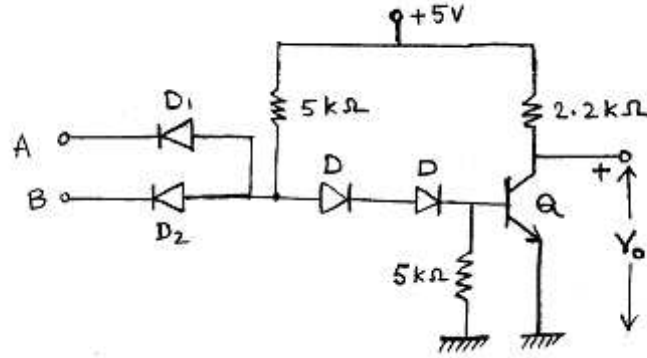


Figure 1:

8. (a) i. Compare weighted resistor D/A converter and R-2R D/A converter.
 ii. Why successive approximation D/A converter is preferable than parallel comparator A/D converter. Explain. [8]
- (b) Draw the schematic block diagram of Dual-slope A/D converter and explain its operation. Derive expression for its output voltage V_o . [8]

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1. Explain in detail all the dc and ac characteristics of an ideal OP-AMP with relevant expressions [16]
2. (a) Define slew rate and derive the expression for it. List causes of the slew rate and explain its significance in applications [10]
(b) Explain the difference between slew rate and transient response [6]
3. (a) Derive the frequency of oscillation of a RC phase shift oscillator and explain the operation of the circuit. [12]
(b) Define supply voltage sensitivity. What is meant by poorly regulated power supply? [4]
4. (a) Explain the operation of Monostable multivibrator using 555 timer and derive the expression for pulse width. [10]
(b) Design a ramp generator using 555 timer having an output frequency of approximately 5KHz [6]
5. (a) What is the major difference between digital and analog PLLs? [10]
(b) Explain the frequency multiplier using IC PLL. [6]
6. (a) Define a Notch filter. Give its application. [4]
(b) Determine the order of the Butterworth low-pass filter so that at $\omega = 1.5\omega_{3dB}$, the magnitude response is down by at least 30 dB. [6]
(c) Design a notch filter for $f_o = 8kHz$ and quality factor $Q=10$. Choose $C=500$ pf and assume necessary data. [6]
7. (a) Draw the circuit of ECL logic OR/NOR gate and verify the Boolean expression. [8]
(b) List out the major advantages of ECL logic. [4]
(c) Explain the functions of a Tri-state TTL gate. [4]
8. (a) Define the following terms with reference to D/A converters. [4]
 - i. Resolution
 - ii. Linearity

- (b) Draw a schematic diagram of a D/A converter. Use resistance values whose ratios are multiples of 2. Explain the operation of the converter. [6]
- (c) Draw the block diagram of a converting A/D converter and explain its operation. Sketch the output waveform. [6]

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(b) what is a level translator circuit? Why is it used with the cascaded differential amplifier used in OP-AMPS? [5]
(c) Explain the term ‘Slew Rate’ and how it affects the frequency response of an an OP-AMP? [4]
2. (a) Derive the expression of the output voltage of an antilog amplifier using OP-AMP [10]
(b) What is a summer? Design a summer to add 4 input voltages in inverting configuration. [6]
3. (a) Derive the frequency of oscillation of a RC phase shift oscillator and explain the operation of the circuit. [12]
(b) Define supply voltage sensitivity. What is meant by poorly regulated power supply? [4]
4. (a) Explain the significance of each of comparators and operation of 555 timer. [6]
(b) Explain the application of 555 timer as Linear ramp generator. [10]
5. (a) Give the block diagram of PLL and explain about each block in detail. [10]
(b) Define the following terms with reference to PLL
 - i. Lock range
 - ii. Capture range
 - iii. Pull-in-time.[6]
6. (a) What are the advantages of active filters over passive ones? [5]
(b) Design a second order low pass Butterworth filter for a cut off frequency of $2kHz$. Assume necessary data. [6]
(c) What is an all pass filter? Draw the circuit of the filters. [5]
7. (a) Define [6]
 - i. Positive logic

- ii. Negative logic
- iii. Pulse logic.
- (b) What is meant by AOI logic. Explain with help of an example. [4]
- (c) In the given circuit silicon transistor is used. Find the out-put levels for the given input levels of 0.2V and 12V, obtained from a preceding stage. Assume $h_{FE}=30$. [6]
- 8. (a) Compare different A/D converters for their merits and demerits. [8]
- (b) Give the schematic circuit diagram of a successive approximation type A/D converter and explain the operations of this system. [8]

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