

II B.Tech. I Semester Supplementary Examinations, May -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) Why is emitter resistor R_E replaced by a constant current bias circuit in differential amplifier stage of an OP-AMP?
(b) Explain why open loop configurations are not used in linear applications
(c) For an OP-AMP, PSRR=70dB(min), CMRR= 10^5 , differential mode gain $A_d=10^5$. The output voltage changes by 20V in 4 microseconds. Calculate i) numerical value of PSRR ii) Common mode gain iii) Slew rate of the OP-AMP.
2. (a) Draw the circuit diagram and explain the operation of an inverting amplifier
(b) Derive the output voltage of an OP-AMP based differential amplifier
3. (a) Derive the frequency of oscillation of a RC phase shift oscillator and explain the operation of the circuit.
(b) Define supply voltage sensitivity. What is meant by poorly regulated power supply?
4. (a) Explain the significance of each of comparators and operation of 555 timer.
(b) Explain the application of 555 timer as Linear ramp generator.
5. Explain the use MC 1496 as AM modulator with necessary circuit diagram.
6. (a) Derive the transfer function for a general second order sallen-key filter with suitable circuit diagram.
(b) Design a Butterworth filter for a given normalized polynomial of $S^2+1.414S+1$. Assume necessary data.
7. (a) List out the advantages of CMOS logic.
(b) Draw the circuit of CMOS NOR gate and verify the Boolean function.
(c) Give the working principle of I^2L logic with neat circuit diagram.
8. (a) List out different types of A/D converters and compare their merits and demerits.
(b) Give the schematic circuit of integrating type A/D converter and explain the operation of this system and derive expression for output voltage V_o .

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2. (a) Explain the differences between ac and dc amplifiers
(b) What is instrumentation amplifier? What are its features? List any three applications of instrumentation amplifier.
3. (a) Derive the frequency of oscillation of a RC phase shift oscillator and explain the operation of the circuit.
(b) Define supply voltage sensitivity. What is meant by poorly regulated power supply?
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) Derive the transfer function for a general second order sallen-key filter with suitable circuit diagram.
(b) Design a Butterworth filter for a given normalized polynomial of $S^2+1.414S+1$. Assume necessary data.

7. (a) Define
- i. Positive logic
 - ii. Negative logic
 - iii. Pulse logic.
- (b) What is meant by AOI logic. Explain with help of an example.
- (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 $h_{FE}=30$.
8. (a) Define the following terms as related to DAC
- i. Accuracy
 - ii. Resolution.
- (b) Define the following terms as related to ADC
- i. Conversion time
 - ii. Percentage resolution.
- (c) Which type of DAC is more preferable? Draw the circuit diagram and obtain expression for output voltage for 4 bits.

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2. (a) Design a differentiator to differentiate an input signal that varies in frequency from 10Hz to about 1K Hz. Draw its output waveform if $\sin 2\pi \times 1000t$ signal is applied.
(b) Explain the principle of operation of a precision full wave rectifier with waveforms.
3. (a) What is a switching regulator? Draw the block diagram of a typical switching regulator and explain its operation.
(b) What are the four types of voltage regulators? Compare the performance of these regulators.
4. (a) Explain the significance of each of comparators and operation of 555 timer.
(b) Explain the application of 555 timer as Linear ramp generator.
5. What is the phase-Locked loop? Briefly explain the roles of Low-pass filter and VCO in PLL.
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. For the given circuit shown below (figure 1):
 - (a) Explain the operations of 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-Margin.

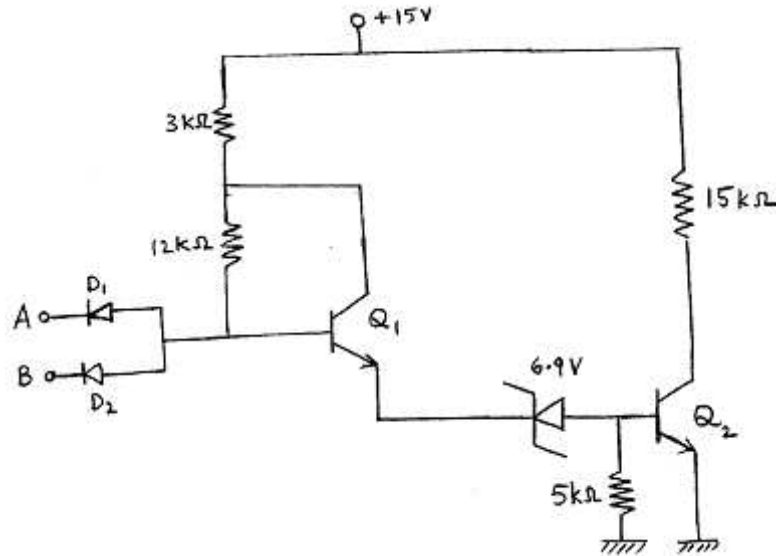


Figure 1:

8. (a) Draw the circuit of a Weighted Resistor DAC and obtain expression for n-bits.
- (b) Sketch the Analog output voltage for the given digital input code.
- (c) What are the major disadvantages in this type?

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1. (a) Derive the expression for CMRR for the first stage differential amplifier
(b) Explain about any two linear and nonlinear applications of OP-AMP
2. (a) Design a differentiator to differentiate an input signal that varies in frequency from 10Hz to about 1KHz . Draw its output waveform if $\sin 2\pi \times 1000t$ signal is applied.
(b) Explain the principle of operation of a precision full wave rectifier with waveforms.
3. (a) Derive the frequency of oscillation of a RC phase shift oscillator and explain the operation of the circuit.
(b) Define supply voltage sensitivity. What is meant by poorly regulated power supply?
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. Explain the operation of the following blocks of PLL in detail
 - (a) Analog and Digital phase detectors
 - (b) Voltage controlled oscillator
 - (c) Low Pass-Filter. Explain their role in the operation of PLL.
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 given circuit explain its operation with the help of Truth Table. Find $h_{FE\min}$, Fan-out if $h_{FE}=30$, and Noise-Margin for the given circuit shown below (figure 2). (Assume all the active devices are made of silicon).
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.

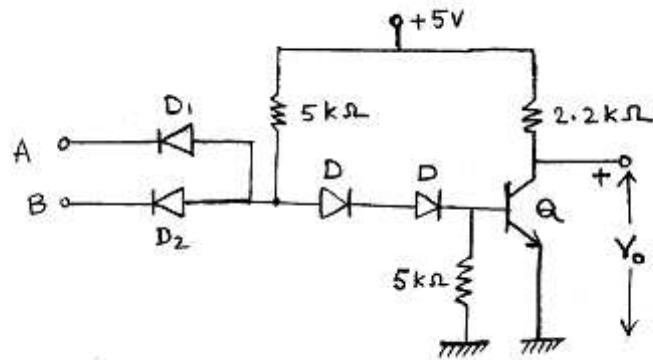


Figure 2:

- (b) Draw the schematic block diagram of Dual-slope A/D converter and explain its operation. Derive expression for its output voltage V_o .
