

III B.Tech. I Semester Supplementary Examinations, May -2005
LINEAR AND DIGITAL IC APPLICATION
(Common to Electronics & Instrumentation Engineering, Bio-Medical
Engineering, Electronics & Control Engineering, Mechatronics and
Electronics & Telematics)

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
(b) Explain about any two linear and nonlinear applications of OP-AMP
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) 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) 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 block diagram of NE 565 PLL and explain the role of each block. Make circuit connections to track the incoming signal and explain its operations.
(b) With neat sketches, explain the following terms:
 - i. Lock-in-range
 - ii. Capture range
 - iii. Pull-in time.
(c) Sketch the capture transient and explain why it is generated before locking?
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) What is meant by AOI Logic. Explain with the help of example.
(b) Draw the circuit of an improved version of D.T.L. 3-input Nand gate, and explain its operations with the help of Truth Table If h_{FE} of each transistor is 40, find FAN-OUT of the circuit.

8. (a) Define the following terms with reference to D/A converters.
- 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.
- (c) Draw the block diagram of a converting A/D converter and explain its operation. Sketch the output waveform.

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1. (a) What are the three differential amplifier configurations? Compare and contrast these configurations.
(b) what is a level translator circuit? Why is it used with the cascaded differential amplifier used in OP-AMPS?
(c) Explain the term ‘Slew Rate’ and how it affects the frequency response of an an OP-AMP?
2. (a) Design a practical integrator circuit to properly process input sinusoidal waveforms up to 1 KHz. The input amplitude is 10mV.
(b) Design a differentiator that will differentiate an input signal with $f_{\max} = 100Hz$
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) 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) Write short notes on :
 - i. Balanced Modulator
 - ii. Voltage Controlled Oscillator
 - iii. Digital Phase Detector.
(b) Give any one applications of PLL and explain it in detail.
6. (a) Explain the operation of a delay equalizer circuit with neat sketches. Derive an expression relating input and output voltages of the equalizer.
(b) For the all pass filter, determine the phase shift between input and output at $f=2\text{ kHz}$. To obtain a positive phase shift. What modifications are necessary in the circuit?
7. (a) Define the following terms :

- i. Fan-in
 - ii. Fan-out
 - iii. Standard load
 - iv. Noise-Margin.
 - (b) Draw the circuit ECL OR/NOR gate and explain its operations with the help of Truth Table.
 - (c) What are the principal advantages of ECL logic (List out at least 5 advantages)
8. (a) Compare different A/D converters for their merits and demerits.
- (b) Give the schematic circuit diagram of a successive approximation type A/D converter and explain the operations of this system.

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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) Define slew rate and derive the expression for it. List causes of the slew rate and explain its significance in applications
(b) Explain the difference between slew rate and transient response
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 one application in which the 555 can be used as a Monostable multi-vibrator.
(b) Design and explain a 555 Astable multivibrator to operate at 10 KHz with 40% duty cycle.
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) Explain the operation of a delay equalizer circuit with neat sketches. Derive an expression relating input and output voltages of the equalizer.
(b) For the all pass filter, determine the phase shift between input and output at $f=2$ kHz. To obtain a positive phase shift. What modifications are necessary in the circuit?

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) Explain the operation of the fastest analog to digital converter. What is the main draw back of this converter? Compare this converter with other types.
(b) Draw the circuit diagram sample and hold circuit and explain its working.

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1. (a) Discuss the electrical characteristics of an OP-AMP in detail.
(b) Draw an ideal voltage transfer curve of an OP-AMP.
(c) What are the features of IC 741?
2. (a) Define slew rate and derive the expression for it. List causes of the slew rate and explain its significance in applications
(b) Explain the difference between slew rate and transient response
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) Define a Notch filter. Give its application.
(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.
(c) Design a notch filter for $f_o = 8\text{kHz}$ and quality factor $Q=10$. Choose $C=500\text{ pf}$ and 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) Explain the operation of the fastest analog to digital converter. What is the main draw back of this converter? Compare this converter with other types.
- (b) Draw the circuit diagram sample and hold circuit and explain its working.

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