

**III B.Tech I Semester Regular Examinations, November 2006**  
**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**

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1. (a) Define the terms : SVRR, CMRR, input bias current, input offset voltage, Gain Bandwidth product [10]  
(b) What are the differences between the inverting and non inverting terminals? What do you mean by the term "virtual ground"? [6]
2. (a) Draw the circuit diagram of a two input non inverting type summing amplifier and derive the expression for output voltage. [7]  
(b) Briefly explain why negative feedback is desirable in amplifier applications [5]  
(c) How does negative feedback affect the performance of an inverting amplifier? [4]
3. (a) What feedback is preferred for oscillators and why? What is the effect of negative feedback? [8]  
(b) Design an OP-AMP based relaxation oscillator and derive the frequency of oscillation. [8]
4. (a) Explain the operation of Monostable multivibrator using 555 timer. Derive the expression of time delay of a Monostable multivibrator using 555 timer. [10]  
(b) Design a Monostable multivibrator using 555 timer to produce a pulse width of 100 m sec. [6]
5. (a) Explain the role of the basic building blocks of PLL. [10]  
(b) Determine the DC control voltage  $v_c$  at lock if signal frequency  $f_s = 10\text{KHz}$ , VCO free running frequency is  $10.66\text{KHz}$  and the voltage to frequency transfer co-efficient of VCO is  $6600\text{Hz/v}$ . [6]
6. (a) Explain the term "VSVS configuration". Design a VCVS low-pass Butterworth second order filter with a cutoff frequency of 4 kHz. Assume necessary data in the design process. [10]  
(b) Design a second order IGMF band-pass filter with the following specifications :  $f_o = 500\text{Hz}$ ; Gain at resonance = -5 and band-width = 50Hz. Use the circuit shown below (figure 6). Assume necessary data [6]

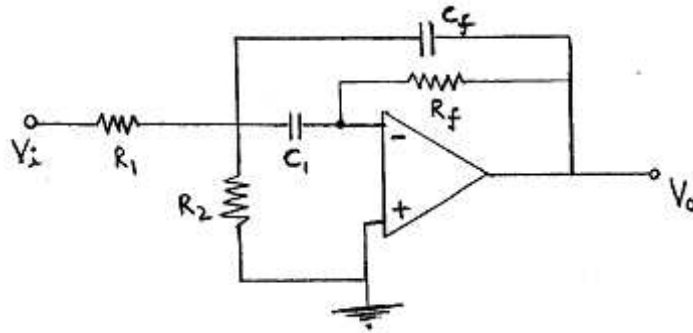


Figure 6

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) Define the following terms as related to DAC [4]
- Accuracy
  - Resolution.
- (b) Define the following terms as related to ADC [4]
- Conversion time
  - Percentage resolution.
- (c) Which type of DAC is more preferable? Draw the circuit diagram and obtain expression for output voltage for 4 bits. [8]

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1. (a) Define the terms : SVRR, CMRR, input bias current, input offset voltage, Gain Bandwidth product [10]  
(b) What are the differences between the inverting and non inverting terminals? What do you mean by the term "virtual ground"? [6]
2. (a) Explain how multiplier can be used to modulate and demodulate an AM signal [8]  
(b) Discuss the differences between the differential amplifiers used in the first two stages of opamp. [8]
3. (a) What feedback is preferred for oscillators and why? What is the effect of negative feedback? [8]  
(b) Design an OP-AMP based relaxation oscillator and derive the frequency of oscillation. [8]
4. (a) Explain the operation of Monostable multivibrator using 555 timer. Derive the expression of time delay of a Monostable multivibrator using 555 timer. [10]  
(b) Design a Monostable multivibrator using 555 timer to produce a pulse width of 100 m sec. [6]
5. Explain the use MC 1496 as AM modulator with necessary circuit diagram. [16]
6. (a) Derive the transfer function for a general second order sallen-key filter with suitable circuit diagram. [8]  
(b) Design a Butterworth filter for a given normalized polynomial of  $S^2 + 1.414S + 1$ . Assume necessary data. [8]
7. (a) Draw the circuit of a Totem-pole TTL NAND gate ? What is the purpose of using a diode at the output stage ? Explain its operation and verify the truth table. [8]  
(b) When do we use open-collector TTL gate? [4]  
(c) Which is the fastest logic gate and why ? [4]
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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1. (a) Why is emitter resistor  $R_E$  replaced by a constant current bias circuit in differential amplifier stage of an OP-AMP? [3]  
(b) Explain why open loop configurations are not used in linear applications [4]  
(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. [9]
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) What feedback is preferred for oscillators and why? What is the effect of negative feedback? [8]  
(b) Design an OP-AMP based relaxation oscillator and derive the frequency of oscillation. [8]
4. (a) Explain the operation of Monostable multivibrator using 555 timer. Derive the expression of time delay of a Monostable multivibrator using 555 timer. [10]  
(b) Design a Monostable multivibrator using 555 timer to produce a pulse width of 100 m sec. [6]
5. (a) Give the schematic circuit of IC 1496 balanced modulator circuit and explain its operation. [8]  
(b) Give the basic block diagram of PLL and explain about each block. [8]
6. (a) Explain the operation of a delay equalizer circuit with neat sketches. Derive an expression relating input and output voltages of the equalizer. [8+2]  
(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? [6]
7. (a) Draw the schematic circuit of TTL active pull-up NAND gate and explain its operation with the help of Truth-Table. [8]

- (b) Draw the schematic circuit of CMOS NOR gate and explain its operation with the help of Truth Table. [8]
8. (a) Define the following terms as related to DAC [4]
- i. Accuracy
  - ii. Resolution.
- (b) Define the following terms as related to ADC [4]
- 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. [8]

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1. (a) Why is it necessary to use an external offset voltage compensating network with practical OP-AMP circuits? [3]  
(b) Compare and contrast an ideal OP-AMP and practical OP-AMP. [5]  
(c) Explain the precautions that can be taken to minimize the effect of noise on an OP-AMP circuit. [5]  
(d) Calculate the effect of variation in power supply voltages on the output offset voltage for an inverting amplifier circuit. [3]
2. (a) Draw the circuit diagram of a two input non inverting type summing amplifier and derive the expression for output voltage. [7]  
(b) Briefly explain why negative feedback is desirable in amplifier applications [5]  
(c) How does negative feedback affect the performance of an inverting amplifier? [4]
3. (a) What feedback is preferred for oscillators and why? What is the effect of negative feedback? [8]  
(b) Design an OP-AMP based relaxation oscillator and derive the frequency of oscillation. [8]
4. Discuss, with relevant circuits and waveforms, the working of Monostable multivibrator using 555 timer. [16]
5. Explain block schematic of PLL. List the application of PLL. [16]
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) List out the advantages of CMOS logic. [4]  
(b) Draw the circuit of CMOS NOR gate and verify the Boolean function. [8]  
(c) Give the working principle of  $I^2L$  logic with neat circuit diagram. [4]

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

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