

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), April-May 2017

B. Tech in ECE/Electrical Engineering, Semester -V

Roll No.....

ECE501: LINEAR INTEGRATED CIRCUITS

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. If a step input signal with step size 'S' volt is applied to the input of an inverting integrator, then the output will be _____.
(a) Pulse with amplitude of S volt (c) ramp signal with slope of -S volt/sec
(b) Square wave with amplitude of $\pm S$ volt (d) triangular wave
- ii. The slope of the frequency response of a 2nd order high pass filter is ____ dB / octave.
(a) 20 (b) 40 (c) -20 (d) -40
- iii. Usually in PLL, the capture range is _____ lock-in range.
(a) Greater than (b) smaller than (c) equals the (d) half of
- iv. Successive approximation type ADC completes n-bit conversion in _____ clock periods.
(a) n (b) 2^n (c) 2n (d) n-1
- v. If the lower & higher cutoff frequencies for the bandpass filter are 150Hz & 250Hz respectively, then the approximate Quality factor (Q) will be
(a) 5 (b) 2 (c) 10 (d) 8
- vi. The 79XX series of voltage regulators produce an output voltage that is _____.
(a) Positive (b) Negative (c) either positive or negative (d) unregulated
- vii. When negative feedback is used, the gain-bandwidth product of an op-amp _____.
(a) Increases (b) decreases (c) remains same (d) fluctuates
- viii. With frequency increased, the gain of the basic differentiator _____.
(a) increases (b) decreases (c) initially increases & then decreases (d) initially decreases, then increases
- ix. A Butterworth filter is characterized by _____.
(a) flat passband & stop band (b) ripple pass band & stop band
(c) flat passband & ripple stop band (d) ripple passband & flat stop band
- x. The ICs with metal can package are usually used for _____ applications.
(a) Air borne (b) bread-boarding (c) high power (d) reliability

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

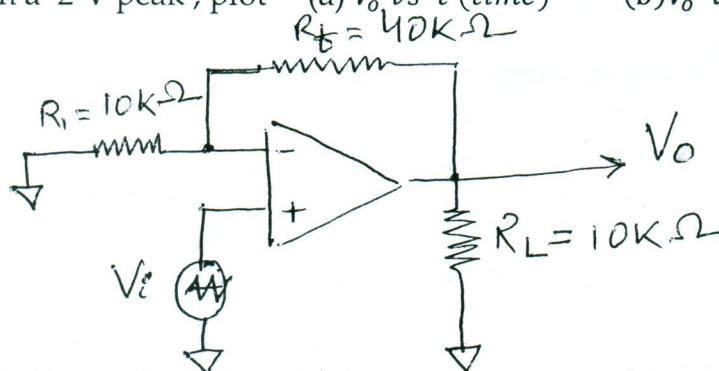
- i. Design a simple 3-input circuit using op-amp to give the output as the average of

the applied signals.

- ii. Design a circuit using op-amp which will convert the input current to its equivalent output voltage.
- iii. Define the following terms for a typical op-amp.
(a) Input offset voltage (b) CMRR (c) Slew Rate (d) SVRR (e) Output voltage swing
- iv. It is required to track the peak values of the observed signal at various instants. Design & explain such a circuit using op-amp which will be used as peak detector.

Q.3A Draw the circuit of a simple inverting amplifier with feedback. Derive the expression for input resistance, output resistance and gain for such an amplifier. 05

Q.3B Find the voltage gain for the following amplifier. If V_i is a 100 Hz triangular wave with a 2-V peak, plot (a) V_o vs t (time) (b) V_o vs V_i 05



Q.4A Design a practical differentiator circuit using op-amp. Draw its frequency response; define the various critical frequencies & outline their importance. State the criteria for designing a good differentiator. 05

Q.4B Design a practical integrator circuit with a dc gain of 10, to integrate a square wave of 10 KHz. 05

Q.5A Design the circuits using op-amp to implement the following equation. 05

$$(a) V_o = 2V_1 + 3V_2 + 0.5V_3 \quad (b) V_o = \frac{V_1 + V_2 + V_3}{3}$$

Q.5B Explain how a full wave rectification can be implemented using operational amplifier. Draw the equivalent circuits for both positive & negative half cycle of the input sine wave. Draw the output waveforms for each case. 05

Q.6A Explain the basic principle of analog multiplier? Show that a basic analog multiplier IC can be configured as frequency doubler? 05

Q.6B State the differences between a clipper and clamper circuit. Draw the circuit of a positive clamper and explain it briefly. Draw the input and output waveforms also. 05

OR

Q.6B What you mean by active filters? Outline the differences among low pass, high pass, band pass, band stop filters. Sketch their respective frequency response and label them properly showing the pass band and stop band regions. 05

Q.7A	Draw the basic circuit of a series regulated power supply. Briefly explain how a fixed series regulator IC can be used as an adjustable regulator.	05
Q.7B	Draw the basic circuit of a log amplifier using op-amp. Verify that the output is really logarithm of its input.	05
OR		
Q.7B	Design a high-pass filter with cut-off frequency of 10KHz and passband gain of 1.5. Also plot the frequency response for the designed filter and locate the cut-off frequency.	05
Q.8A	Design a fourth order Butterworth low-pass filter having upper cutoff frequency 1 KHz. Assume the capacitance, $C = 0.1\mu F$ and the normalized Butterworth polynomial (4 th order) as $(s_n^2 + 0.765 s_n + 1)(s_n^2 + 1.848 s_n + 1)$.	10
Q.9A	What is PLL? Draw the block diagram and explain in detail each component. For an arbitrary input signal draw the out of the Exclusive-OR & Edge-triggered phase detector.	10
Q.9B	Design a wide band-pass filter with lower & higher cutoff frequencies as 400Hz & 2 KHz respectively. The pass band gain of the filter is 4. Draw the frequency response of the filter & also calculate the Q value of the filter.	10
OR		
Q.9B	Explain the principle of basic DAC technique. Draw the circuits and make a comparison amongst Weighted Resistor, R-2R ladder & Inverted R-2R ladder DAC techniques.	10