BITS, PILANI - DUBAI CAMPUS

KNOWLEDGE VILLAGE, DUBAI

III-Year II- Semester 2006- 2007

COMPREHENSIVE EXAMINATION (Closed Book)

COURSE TITLE: ANALOG ELECTRONICS **COURSE NO: INSTR UC364**

DURATION: 3 Hours **Date: 21-05-07** **MARKS: 60** **Weightage: 30%**

NOTE:

i. Answer all Questions.
ii. Assume any missing data suitably and mention it explicitly
iii. Answer all parts of question in continuation. Do not leave any blank page in between the answers

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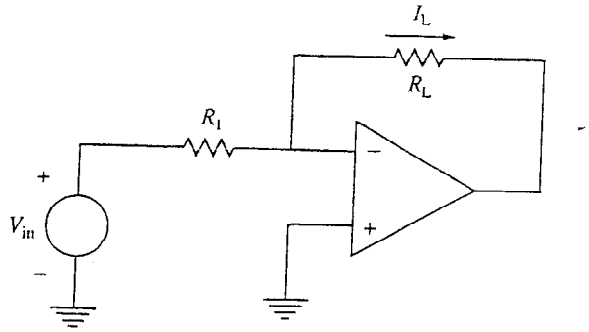
1) (a)Draw a neat sketch of an isolation amplifier using optical isolation. Explain its working.(4 marks)

(b)Figure shows a voltage-to-current converter. Given $V_{in} = 2$ V, $R_1 = 1$ kΩ, maximum output voltage of the op-amp, $V_{omax} = \pm 15$V, and maximum output current through the op-amp, $I_{omax} = \pm 10$ mA. Determine

(i) maximum value of R_L that can be used and

(ii) maximum value of V_{in} that can be used given $R_1 = 1$kΩ and $R_L = 0$ Ω (4 marks)



2) (a) Explain the working of a successive approximation register A/D converter with a neat sketch. Take analog input as 10.6V.Find what is the digital output. Show the full table. (5 marks)

(b)What is the output of the R – 2R ladder for the input pattern1010? Take $R_F = 3R$ (3 marks)

3) What is RTD? Explain with a neat sketch. (3 marks)
Design a basic temperature sensor using LM335, given dc supply voltage of 5 V. (3 marks)

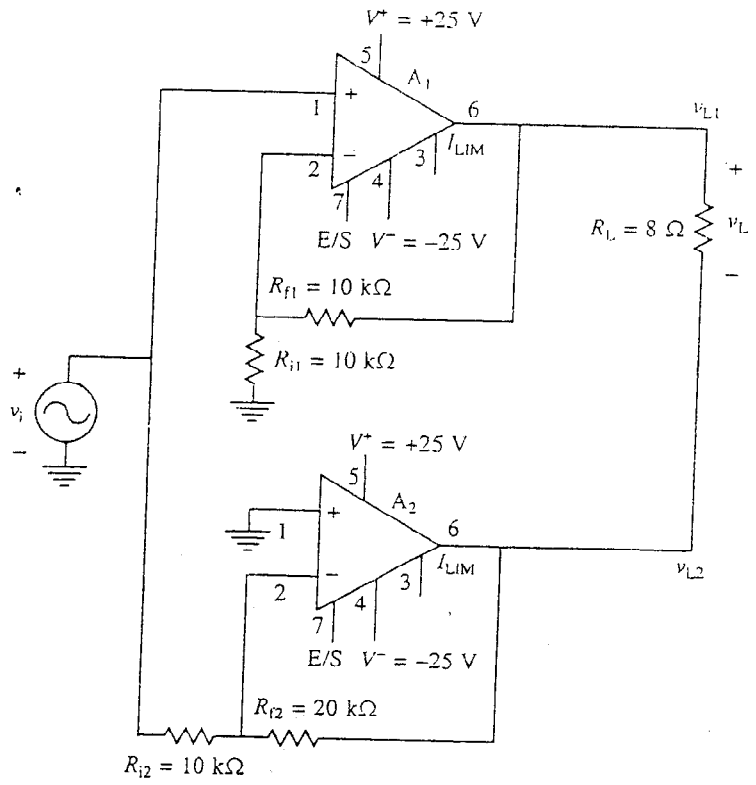
4) Design a second order low pass filter at a high cutoff frequency of 1kHz. Take

C2 = 0.0047 μF, R1 = 27 kΩ
Draw the frequency response of the network in your answer book(Take f = 10Hz, 200 Hz, 700 Hz, 1 kHz, 3kHz, 10kHz, 100kHz). No need to use semi log sheet or graph sheet. (8 marks)

5) (a)Calculate the values of R1 and R3 (given R2 = 2.2kΩ) for a high voltage IC723 regulator so as to get an output voltage of 28 V. (4 marks)
(b)Design a current limit circuit for IC723 regulator to limit the current to 60 mA. (4 marks)

6) An inductance of 36 μH is resonated with a 1000 pF capacitor. Find f_O and Q of the resonator if R_P = 9kΩ (6 marks)

7) The following bridge power amplifier uses OPA 548 op –amp. For a peak sinusoidal input of 10 V peak, find the output voltage, power delivered to the load and peak current drawn from each amplifier. (8 marks)



8) Draw a Schmitt trigger circuit. (2 marks)
(a)If R_1 = 22 Ω, R2 = 10 kΩ and V_i = 50(sin 2π* 100t) mV and op-amp used is 741 op-amp calculate hysteresis voltage. Take $V_{sat} = \pm 15$V. (3 marks)
(b) Explain how this circuit responds to V_i = 30(sin 2π* 100t) mV (3 marks)

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TEST – II (Open Book)

COURSE NO: INSTR UC364 — COURSE TITLE: ANALOG ELECTRONICS

TIME: 50 minutes — MARKS: 20 — WEIGHTAGE:(10%)

ONLY TEXT BOOK AND CLASS NOTES (NOTE BOOK) ALLOWED

NOTE: (Answer all Questions, Data provided are complete)

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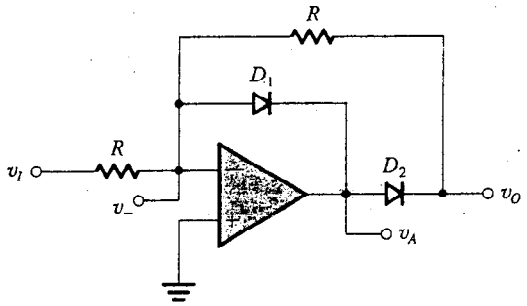
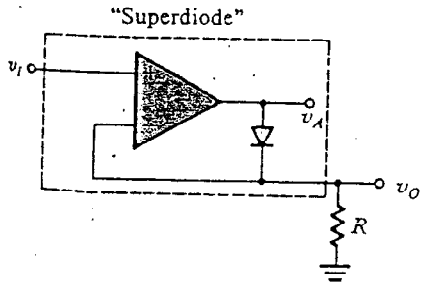
1) The op-amp in the following diagram is ideal with output saturation levels of ±12V. The diodes exhibit a constant 0.7V drop when conducting. Draw the transfer characteristics for this circuit. Find V_-, V_A and V_0 for:
   (a) $V_I = +1V$
   (b) $V_I = -2V$ Explain. [6 marks]



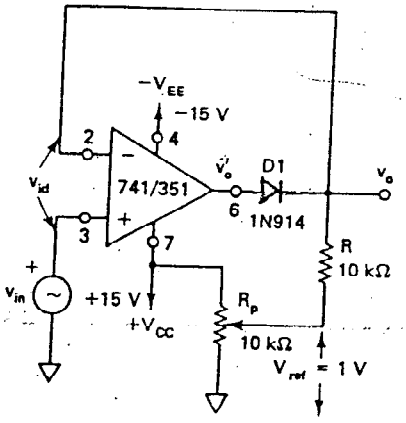
2) In a monostable multivibrator circuit(using 555) charging capacitor = 1nF
   (a) Find the value of R that result in an output pulse of 10μs duration.
   (b) If the 555 timer used in (a) is powered with $V_{cc} = 15V$ and assuming that V_{TH} can be varied externally (i.e., it need not remain equal to 2/3 V_{cc}) find it's required value so that the pulse width is increased to 20 μs, with other conditions the same as in (a) [4 marks]

3) Design a triangular waveform generator using comparator and integrator so that $f_0 = 2KHz$ and $V_0 = 7V(p\text{-}p)$. Supply voltage is ±15V and $V_{sat} = 14V$. Take $R_2 = 10K\Omega$, $C_1 = 0.05\mu F$ [3 marks]

4) The following circuit can be made to have gain by connecting a resistor R_2 in place of the short circuit between the cathode of the diode and the negative input terminal of the op-amp, and a resistor R_1 between the negative input terminal of the op-amp and ground. Design the circuit for a gain of 2. For a 10V peak -to-peak input sine wave, what is the average output voltage resulting? Draw the output waveform. Mark amplitude and time. [5 marks]



5) In the following circuit V_{in} = 2V(peak). Draw both input and output waveforms. [2 marks]



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III-Year II- Semester 2006- 2007

TEST – I (Closed Book)

COURSE NO: INSTR UC364 | COURSE TITLE: ANALOG ELECTRONICS

TIME: 50 minutes | MARKS: 20 | WEIGHTAGE:(10%)

NOTE: (Answer all Questions, Data provided are complete)

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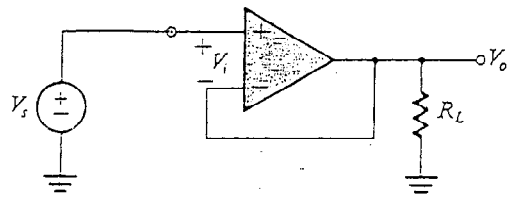
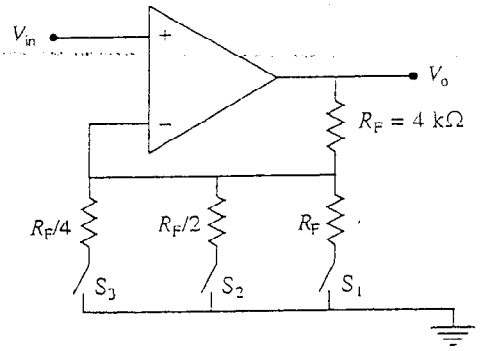
1) Consider a symmetrical square wave of 20V peak- to - peak, 0 average, and 2ms period applied to an integrator. Find the value of time constant RC such that the triangular waveform at the output has a 20V peak- to – peak amplitude. Sketch input and output waveforms with all voltages marked. [4 marks]

2) A non - inverting op-amp configuration is shown in figure. Assume that the op-amp has infinite input resistance and zero output resistance. If A=100, what is the closed loop voltage gain? What is the amount of feedback in dB? If A decreases by 10%, what is the corresponding decrease in A_f ? (Express it in percentage.) [4 marks]



3) Design an inverting op-amp circuit to form the weighted sum V_o of two inputs V1 and V_2. It is required that $V_o = -(V_1+5V_2)$. Choose values for R_1, R_2 and R_f so that for a maximum output voltage of 10V the current in the feedback resistor will not exceed 1mA. [4 marks]

4) In the following circuit V_{in} = .1V. Calculate the gain of the amplifier for all the combinations of the switch. [4 marks]



5) A 1V battery with an internal resistance of 5 ohms is to be connected to a load of 20 ohms. Calculate the voltage across the load. Connect a voltage follower in between the load and battery and again calculate the load voltage. [4 marks]