Total number of printed pages: **Programme (UG)/5th /UECE 515C**

2022

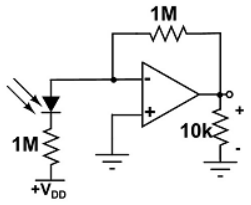
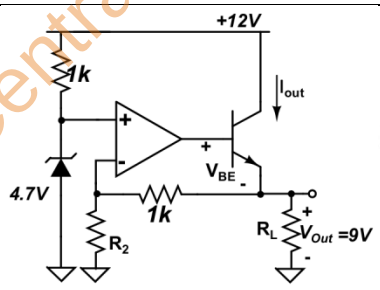
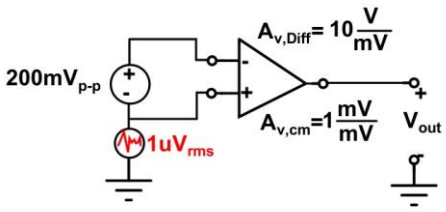
Linear Integrated Circuits And Systems

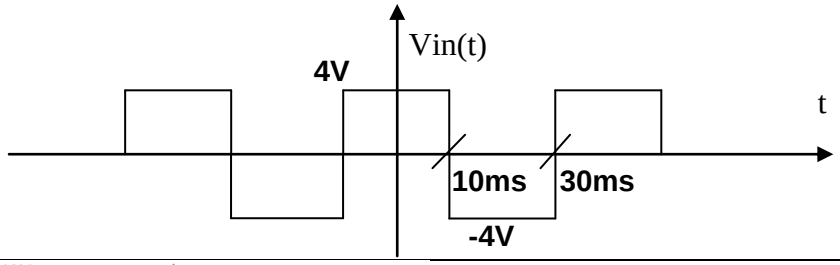
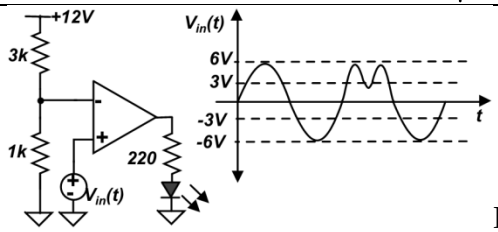
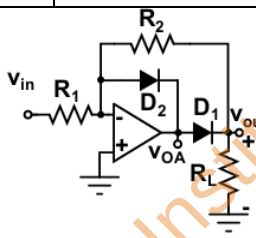
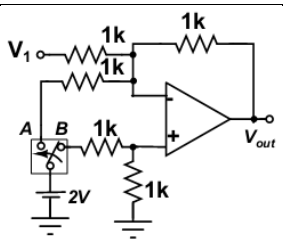
Full Marks : 100

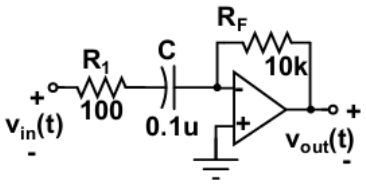
Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	P-I-N photodiode of responsivity 0.8A/W is connected to the inverting input of an ideal opamp as shown in the figure, ±Vcc = ±15 V, Load resistor RL =10 kΩ. If 10μW of power is incident on the photodiode, then calculate the value of the photo current through the load. 	6
	b)	Draw a opAmp based circuit diagram that can take 2 inputs $v1$, $v2$ and deliver output voltage of the form of; $v_{out=}\frac{k.T}{q}ln\left(\frac{v1}{v2}\right)$. Explain the mathematical derivations leading to output voltage.	8
	c)	Describe the operation of a Schmidtt Trigger circuit with waveform and transfer characteristics. Mention the advantages of it with normal comparators.	6
2.	a)	 Figure 2 a  Figure 2 b Find the value of the resistor R2 the BJT used has $V_{BE} = 0.7V$ and high value of β.	6
	b)	An op amp based circuit is shown in Fig. 2 (b). Find the expression for the	2+2 = 4

		output voltage and CMRR of Opamp in dB?	
	c)	Determine the output waveform from a true integrator for the input waveform as shown, which is governed by the equation: $Vout(t) = \int_0^t Vin(t) + Vout(0)$. Assume capacitor is initially relaxed. 	8
3.	a)	 Draw the output waveform of the comparator and find out the number of times the LED glows assume ±15V supply.	8
	b)		2X2 = 4
		i) Draw the circuit diagram of a VCVS whose gain is positive and input resistance is ideally infinite.	
		ii) Write a short note on input referred offset for an Op-Amp.	
	c)	 Explain the operation of the circuit by taking a sine wave input, draw the waveforms for $V_{in}(t)$, $V_{Out}(t)$, $V_{OA}(t)$. Plot the voltage transfer characteristics.	4+2+2
4.	a)	Describe the operation of saturated precision rectifier for first quadrant operation with proper circuit diagram and plot the voltage transfer characteristics.	8+2
	b)	 For the circuit shown in Figure Output voltage Vout=VoA for switch SW	5+5

		in position A and Vout=VoB for SW in position B. Assume that the opamp is ideal. The expression of VoA, VoB.	
5.	a)	Draw the circuit diagram for a 4bit R-2R Digital to Analog Converter and find the value of the output voltage if: R=10kΩ, Rf=10kΩ, Vref=10V.	2+4 =6
	b)	Draw the design flow of electronic system.	6
	c)	Derive the expression for the transfer function, plot the gain response vs frequency and find the range frequencies for it can operate as a differentiator. 	8
6.			
	a)	Draw the circuit diagram of square wave generator in astable mode with an op-amp. Find the expression for the frequency.	10
	b)	Draw the circuit diagram of the difference amplifier with op-amp and derive the expression for the output voltage.	10
7.	a)	Draw the circuit diagram of a Anti-log amplifier with op-amp and derive the expression for the output voltage and mention it's applications in signal processing.	8
	b)	Design a VCVS whose Rin=10kΩ, expected gain is -2V/V. Find the expression for the output if the input analog signal is $Vin(t) = 3\cos 50\pi t + 1.5\sin 300\pi t - 3.5\cos 100\pi t$	8
	c)	Draw the non-ideal model of an op-amp with finite band width and infinite Rin and non zero Rout.	4