Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3141002 Date:11-01-2024

Subject Name:Analog Circuit Design

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	List all the characteristics of an ideal OP-AMP.	**03**
	(b)	Explain how and why does trans-conductance varies with increasing $\|I_c\|$, $\|V_{CE}\|$ and Temperature at high frequency.	**04**
	(c)	You are given a set of components as follows: Resistors- 2.2 kΩ(2), 3.9kΩ(2), 4.7kΩ(2) a capacitor-0.1µF and an IC555.Design an astable multi-vibrator with free running frequency of approximately 1 kHz. Draw the final design with pin connections and values of each component chosen by you as your answer. Also, show all the calculations related to your design.	**07**
Q.2	**(a)**	Give full forms of: CMRR, PSRR, PLL	**03**
	(b)	Explain the concept of virtual ground and discuss how it is different from actual ground.	**04**
	(c)	Derive an expression for the short circuit current gain for the hybrid-π model in CE configuration.	**07**
		OR	
	(c)	Derive an expression for emitter diffusion capacitance in terms of base width, diffusion constant and trans-conductance for the hybrid- π model in CE configuration.	**07**
Q.3	**(a)**	Give full forms: ADC, HPF, VCO	**03**
	(b)	Compare Class A and Class B amplifiers.	**04**
	(c)	Derive an expression for the frequency of oscillations for the Wein bridge oscillator.	**07**
		OR	
Q.3	**(a)**	What is an electronic filter? List all types of electronic filters.	**03**
	(b)	Compare current series feedback with current shunt feedback.	**04**
	(c)	A CE amplifier with an un-bypassed emitter resistance providing current series feedback to be designed for trans-conductance gain of -1 mA/V, voltage gain of -4 and a desensitivity of 50. If R_s=1KΩ, h_{fe}=150 and $r_{bb'}$ is negligible, find (i) R_e, (ii)R_L,(iii) R_{if} and (d) $I_{C(quicent)}$.	**07**
Q.4	**(a)**	Define: Slew rate, Input bias current, Input offset current	**03**
	(b)	Explain the working of Class AB amplifier in brief.	**04**
	(c)	A Second Order Low Pass Filter is to be designed around a non-inverting op-amp with equal resistor and capacitor values in its cut-off frequency determining circuit. If the filters characteristics are given as: quality factor Q = 5, andcorner frequencyf_c = 159Hz, design a suitable low pass filter. Assume R=10 kΩ.	**07**
		OR	

Q.4	**(a)**	In the Colpitts oscillator, C_1=0.2 µF C_2=0.02 µF. If the frequency of oscillation required is 10 kHz, find the value of inductor.	**03**
	(b)	Explain Barkhausen criterion for oscillations.	**04**
	(c)	Describe the complete process of state variable filter design in details.	**07**
Q.5	**(a)**	Give full forms: ECL, VCVS, GBP	**03**
	(b)	Give complete classification of oscillators.	**04**
	(c)	Derive the expressions for the voltage gain and input resistance with feedback for an emitter follower circuit.	**07**

OR

Q.5	**(a)**	Calculate the frequency of oscillations for an RC phase shift oscillator given R=10KΩ and C=0.1 µF.	**03**
	(b)	For a non-inverting OP-AMP summing circuit with inputs of 1V,2V and 3V, respectively, R_f=2KΩ and R_{in}=1KΩ. Determine output voltage.	**04**
	(c)	Design an adjustable voltage regulator using LM317 to satisfy the following specifications: Output Voltage=5 to 12 V, Output current=1.0 A. I_{ADJ}=100 µA. Assume R_1=240Ω.	**07**

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