Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code:2141002 **Date:26/05/2015**

Subject Name: Analog circuit design

Time:10:30am-1.00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Draw Hybrid -π equivalent circuit for CE transistor. Also derive the equation of input conductance $g_{b'e}$.	**07**
	(b)	What is an oscillator? Explain the concept of oscillation with Barkhausen criteria.	**07**
Q.2	**(a)**	A BJT has following parameters. hie=1 kΩ, hfe=100, hre and hoe are negligible. Cc=3pF. Collector current is 10 mA at room temperature. The short ckt. Current gain is 10 at frequency 10 MHz. Calculate values of fα, fβ and fT.	**07**
	(b)	Derive the expression for voltage gain, input resistance, output resistance of an inverting amplifier using op-amp with negative voltage shunt feedback.	**07**
		OR	
	(b)	Draw circuit diagram of differential amplifier with two op-amps and derive expression for its output signal as a function of input signals. Also derive expressions of input resistance faced by each input signal.	**07**
Q.3	**(a)**	What are the characteristics of an ideal op-amp? Draw its equivalent circuit of op-amp and explain voltage transfer curve.	**07**
	(b)	Design an op-amp based practical differentiator circuit to differentiate an input signal that varies in frequency from 10 Hz to 1 kHz. Draw output waveform of the designed differentiator circuit for an input signal with 2V peak-to-peak amplitude with 1 kHz frequency.	**07**
		OR	
Q.3	**(a)**	What is an instrumentation amplifier? Explain with the help of neat diagram the operation of an instrumentation amplifier employing three basic op-amps.	**07**
	(b)	Design an input offset voltage compensating network for the inverting amplifier with R_1 = 100Ω and R_F = 4.7 k Ω. The op-amp is LM307 with Vio = 10 mV and supply voltages ± 10V.	**07**
Q.4	**(a)**	Explain SMPS (switched mode power supply) with necessary circuit diagram and waveforms.	**07**
	(b)	Which type of feedback is used in Schmitt trigger circuit? Discuss its operation and derive expressions for lower and upper threshold voltage. Design the Schmitt trigger circuit for upper and lower threshold voltage equal to 25 mV and -25 mV. Op-amp maximum output voltages are ± 14 V. Take ± 15V as op-amp supply voltage.	**07**
Q.4	**(a)**	Explain the working of Monostable multivibrator using IC 555.	**07**
	(b)	Explain how op-amp can be used to generate free running square wave with necessary circuit diagram and waveforms. Show how time period can be calculated.	**07**
Q.5	**(a)**	Discuss magnitude and frequency scaling in filter design.	**07**

	(b)	Draw Sallen-key LPF circuit and obtain its transfer function.	**07**

OR

Q.5	**(a)**	Draw first order butterworth LPF circuit and derive the equation of Gain. Also draw the frequency response of it.	**07**
	(b)	What is differential amplifier? Describe the operation of emitter coupled differential amplifier.	**07**

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